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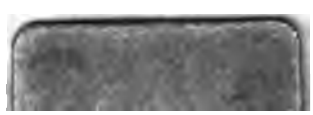

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Qua difficilia, hæc præclara.

Third American, from the Fourth London Edition.

EDITED, WITH ADDITIONS,

BY

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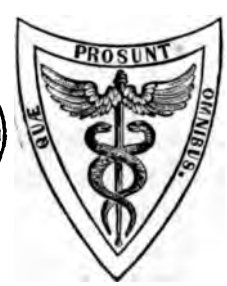

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PREFACE.

In the preparation of the Fourth Edition of this work, the author has found it necessary to revise the whole of the chapters. Numerous additions and alterations have been made, and many important cases of recent occurrence have been introduced.

Under Poisoning, the additions include a notice of the new enactments affecting medical evidence, and of the recent decisions regarding the administration of poison,—some new facts and cases illustrative of the action of arsenic, opium, strychnia, the salts of lead, antimony, and other poisons,—as well as improvements in the application of chemical tests for the detection of poisons:—under Wounds, the changes produced by the new statutes,—cases of peculiar and severe suicidal wounds,—struggling and power of exertion in wounds of the heart,—processes for the detection of blood-stains, and their distinction from vegetable dyes,—the examination of weapons and projectiles,—additional facts regarding burns on the living and dead bodies: under Child-murder, medical evidence derivable from an examination of the umbilical cord, with references to many new cases. Additions have been made under Abortion, on the action of oil of savin:—under Legitimacy, on the duration of pregnancy,—proofs from the development of offspring,—plural and twin births:—under Rape, fallacies attending evidence from the examination of females: under the various forms of death from Asphyxia,—additional facts regarding the examination of the bodies of persons who have died by drowning, hanging, strangulation, and suffocation,—facts and cases illustrating the means of distinguishing homicidal from suicidal strangulation—under Insanity, some additions on the application of Restraint,—decisions in recent cases, showing the liability of medical practitioners,—the testimonial capacity of the

Insane, with remarks and cases illustrative of Homicidal Mania and the Plea of Insanity.

The author has reason to believe that this small volume has already found a wide circulation, not only among members of his own profession, but among gentlemen practising at the bar. To many of these he has to express his obligations for suggestions which he has received, as well as for numerous important facts which they have kindly communicated to him. In order to meet the wishes of those members of the bar who make the book a kind of Circuit companion, a glossary containing some professional terms used in the volume has been added.

To make the work complete, the author proposes with the least possible delay to publish a treatise on a much larger scale, and printed in larger type. This new and enlarged volume will embrace not only many facts and cases to which it has been impossible to give more than a brief reference in the small work now published, but also some subjects of great interest in medical jurisprudence, for a notice of which it has not hitherto been possible to find room. The new subjects thus proposed to be introduced, are the various modes of DEATH,—SUDDEN DEATH,—the SIGNS OF DEATH,—the changes in the dead body, including PUTREFACTION,—determination of the period of death, —the disinterment of bodies,—examination of bones in reference to sex, age, stature, race, period of interment, and other circumstances,—AGE and PERSONAL IDENTITY,—PRESUMPTION OF SURVIVORSHIP,—LIFE INSURANCE,—and FEIGNED and DISQUALIFYING DISEASES.

The author cannot close this notice without thanking the members of the Legal and Medical professions for the very great encouragement which they have hitherto extended to his labours in the science of Medical Jurisprudence.

GUY'S HOSPITAL, June, 1852.

PREFACE

TO THE THIRD AMERICAN EDITION.

THE great popularity of Dr. Taylor's Medical Jurisprudence is abundantly proved by the rapid disposal of several editions. This already wide circulation, and the author's long established reputation, render it unnecessary to dwell upon the merits of his manual as a standard authority to members of the legal and medical professions.

It will be seen by the author's preface and the body of the work that many advantageous changes have been made, and a large amount of important matter added, in such a manner as very slightly to augment the volume, while they have materially enhanced its value. In this way, we think, the author has succeeded in producing a book which, however incomplete it may appear to one of his great learning and rigorous exactness, will nevertheless, for practical availability as a means of constant reference, go very far to lessen, at least in this country, the demand for a voluminous and costly treatise, such as he anticipates preparing at a future day.

The last English edition is brought so fully up to the level of its date, and so short a period has since elapsed, that the duties of the present editor have been comparatively light. He has taken care to incorporate in his own notes such of the additions of his predecessor, the late Dr. R. E. Griffith, as had not been used by Dr. Taylor, or as it seemed on other accounts desirable to retain. He has endeavoured, also, whilst avoiding any increase of bulk as much as possible, to present all the important facts and cases that have recently occurred within his knowledge, especially in this country; and he trusts that he has thus added somewhat to the usefulness of this reprint among his countrymen, if not to its interest generally, as the latest publication on the subject.

The additions are, as usual, inclosed within brackets, and are marked with the letter H. The Glossary which has been appended by the author for the benefit of members of the bar, although brief, has not been interfered with, because the American editor did not feel at liberty either to alter or to leave it out. It would be better for readers of every kind—legal, medical, and general—who are in need of explanations, to look at once to such a dictionary as DUNGLISON'S MEDICAL LEXICON, a book which no criminal lawyer or careful general reader should ever be without, rather than to the best glossary that could be given at the end of any work on Medical Jurisprudence.

E. H.

453 Walnut St., Philadelphia,
May, 1853.

ERRATA.

Page 431, sixth line from top, the words, "i. e. usual in the female, we suppose," should be enclosed within brackets.

Page 462, fourth line from bottom, for "Brownsègnard" read Brown-Sèquard.

Page 466, first line of second paragraph, same as above; and on second line of same paragraph omit the word "no."

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MEDICAL JURISPRUDENCE.

POISONING.

CHAPTER I.

DEFINITION OF THE TERM POISON—MEANING OF THE WORDS DEADLY POISON—LEGAL DEFINITION—MECHANICAL IRRITANTS—INFLUENCE OF HABIT AND IDIOSYNCRASY ON POISONS—CLASSIFICATION OF POISONS—SPECIAL CHARACTERS OF IRRITANTS, NARCOTICS, AND NARCOTICO-IRRITANTS.

Definition.—A POISON is commonly defined to be a substance, which, when administered in small quantity, is capable of acting deleteriously on the body. It is obvious that this definition is too restricted for the purposes of medical jurisprudence. It would, if admitted, exclude numerous substances, the poisonous properties of which cannot be disputed; as, for example, the salts of lead, copper, tin, zinc, and antimony, which are only poisonous when administered in very large doses. Nitre, it is well known, exerts a poisonous action only in large, while arsenic is poisonous in small doses; but in a medico-legal view, whether a person die from the effects of an ounce of nitre, or five grains of arsenic, is a matter of little importance. Each substance must be regarded as a poison, differing from the other only in its degree of activity, and perhaps in its mode of operation. The result is the same; death is caused by the substance taken, and the *quantity* required to kill cannot, therefore, be made a ground for distinguishing a poisonous from a non-poisonous substance. If, then, a medical witness be asked, "What is a poison?" he must beware of adopting this common definition, or of confining the term poison to those substances only that operate in *small* doses.

The fact that a poison has been commonly regarded as a substance which produces serious effects when taken in small quantity, has induced many who have adopted this arbitrary view to assert that certain substances which have actually been known to cause death, are not poisons; and this doctrine has been apparently strengthened by the fact, that were not some such distinction adopted, it would be difficult to separate the class of poisons from bodies which are reputed inert. In answer to this view, it is, perhaps, sufficient to show that there is no good reason for assuming this as the distinguishing character of a poison; for it is impossible, even among substances universally admitted to be poisonous, to make any division according to the effects produced by the *quantity* taken. In relation to the quantity required to operate fatally, the difference is not so great between cream of tartar and oxalic acid as between oxalic acid and strychnia.

Deadly Poison.—There is another point of view in which this question may require to be considered, namely, What is to be understood by a *deadly* poison?

In most indictments for poisoning, it is customary to describe every poison as *deadly*,—a form of expression decidedly bad, and calculated to give rise to technical objections. The substance administered might, with equal propriety, be described as poisonous, or of a destructive nature: but those who draw up indictments are but little informed on such matters, and they can never speak of a poison without describing it as deadly. This term can be applied with propriety only to those poisons which may prove speedily fatal in small doses,—*e. g.*, prussic acid, arsenic, aconitina, and nicotina; and although it has been used in indictments in reference to such substances as blue and green vitriol, or common sal volatile, this has arisen from an unnecessarily strict adherence to old legal forms. In a case (*Reg.* v. *Haydon*, Somerset Spring Assizes,) in which "spirit of hartshorn" was thus described as a "deadly poison," and an objection was taken to the validity of the indictment, the learned judge (Earle J.) held that the word *deadly* was not essential: it was mere surplusage. (Law Times, April 12, 1845.) This decision is in accordance with common sense.

In legal medicine, it is difficult to give such a definition of a poison as shall be entirely free from objection. Perhaps the most comprehensive definition which can be suggested is this:—"A poison is a substance which, when taken internally, is capable of destroying life without acting mechanically on the system." But it is well known that some substances act as poisons by absorption when applied to the skin of a wounded surface; while others again, as the poison of the viper, and of rabies, may have their fatal effects limited to those cases in which they are introduced by a wound: and a third class may destroy life merely by their chemical effects upon the parts with which they come in contact, without necessarily poisoning the blood by *absorption; e. g.* sulphuric acid. These facts show that it is very difficult to comprise in a few words an accurate description of what should be understood by the term "poison."

Legal definition.—In reference to the *medical* definition of a poison, it is necessary to observe that the law never regards the manner in which the substance administered acts. If it be capable of destroying life, or of injuring the health of an individual, it is of little consequence, so far as the responsibility of a prisoner is concerned, whether its action on the body be of a mechanical or chemical nature. Thus a substance which simply acts mechanically on the stomach, may, if wilfully administered with intent to injure, involve a person in a criminal charge, as much as if he had administered arsenic or any of the ordinary poisons. It is, then, necessary that we should consider what the law strictly means by the act of poisoning. If the substance criminally administered destroy life, whatever may be its nature or mode of operation, the accused is tried on a charge of murder or manslaughter, and the whole duty of the medical witness consists in showing that the substance taken was the certain cause of death. If, however, death be not a consequence, then the accused is tried under a particular statute for the attempt to murder by poison. (1 Vict. c. 85, sec. 2.) The words of this statute are very general, and embrace all kinds of substances, whether they be popularly or professionally regarded as poisons or not. Thus it is laid down that—

"Whosoever shall administer, or cause to be taken by any person, any poison, or other destructive thing, with intent to commit murder, shall be guilty of felony, and, being convicted thereof, shall suffer death."

Whether the administering be followed by death or bodily injury dangerous to life, it is still a capital felony, provided the *intent* have been to commit murder. The same administering with intent, &c., although no bodily injury be effected, is felony, punishable by transportation for life, for fifteen years, or imprisonment for any term, not exceeding three years. [In all the states of our Union wilful but unsuccessful attempts to destroy life by poison are ranked among the higher crimes; and in the Revised Statutes of New York it is now provided that similar attempts shall be punished by ten years' imprisonment in a state prison. Revised Statutes, ii. 665. The following also are treated as offences in the same enact-

ments: "Mingling poison with any food, drink, or medicine, with intent to kill or injure any human being; wilfully poisoning any spring, well, or reservoir of water; and administering, or exposing any poisonous substance so that it should be taken by any horse, cattle, or sheep." Ibid. 666, 689. "If any physician, while in a state of intoxication, shall, without a design to effect death, administer any poison, drug, or medicine, or do any other act to another person, which shall produce the death of such other, he shall be deemed guilty of manslaughter." Ibid. 662. "If, under the same circumstances, a physician, or any other person, prescribes either of the above, and life is endangered, it is declared a misdemeanor." Ibid. 694. Vide Beck's Med. Jurisp. ii. 373. A stringent act for the regulation of the sale of poisons, and resembling the present British law, is now in force in the state of Ohio, but we are informed that its provisions are not regarded. H.] From the words of the statute it appears that the law requires, in order to constitute the crime of poisoning, that the substance should be *administered to*, or be *taken by*, an individual. Several deaths have been caused of late years by the external application of arsenic and corrosive sublimate to ulcerated and diseased surfaces. Supposing that poison is thus applied intentionally, and great bodily injury is done to the individual, it might be a question whether the crime could be punished under these sections of the statute. Lord Campbell's act (14 and 15 Vict. c. 19,) appears to provide for this description of offence, although the application or administration is herein limited to chloroform, laudanum, or other stupifying drug. The external application of arsenic in a way to produce personal injury would, no doubt, be considered an act of administration.

[In a former edition Dr. Griffith observes, "As the laws of most, if not all, the states, use the word poison, without defining it, a medical witness is liable to be called upon to declare whether certain substances are, or are not, to be considered as poisons: in some instances, as may be seen, this is extremely difficult. Were our laws so modified as to define the crime of poisoning to be the administration of any destructive article with an intent to kill, there would be but little ambiguity; but, as the statutes now stand, it is almost impossible to decide what are to be regarded as poisons: thus, whilst a death by the administration of one of the mineral acids is, without hesitation, considered as "by poison," it is extremely doubtful whether a murder by pouring boiling water into the mouth would be so ruled, and yet the injuries causing death are essentially the same in both instances, each acting as a mechanical irritant. So also, when a person throws sulphuric acid on another, and death is the result, is it to be regarded as a case of death by poison? The substance employed is admitted to be a poison, when given internally; would it be so, when applied externally? The definition of a poison, in the text, is a modification of that given by Duvergie (*Med. Leg.* ii. 430,) and, though better than that of most authors, is deficient in not including poisons acting externally. Now, it is well known that many of the admitted poisons are capable of inducing death when applied to the surface, as, for instance, arsenic, strychnia, &c. The following will include almost all cases that can occur: 'A poison is a substance which, when taken internally, or applied to the surface of the body, is capable of destroying life, without acting in a purely mechanical manner.' Mr. Taylor (*Poisons*, 18) objects to this definition, as not sufficiently precise, but it is certainly as much so as the nature of the case will admit."

The foregoing note of Dr. G. is retained without alteration, although we are disposed to admit the force of Mr. T.'s objection above acknowledged. "Can it be said," he justly asks, (*loc. cit.*) "that boiling water, or oil, or melted lead, when applied to the surface of the body, destroy life by exercising a mechanical action? If not, then these liquids are poisonous. If, however, this kind of action be regarded as mechanical, then the mineral acids and alkalies must also be considered by their effects to act mechanically whether applied to the skin or the mucous membrane of the stomach." We must remember too that even if

the law described the act of poisoning to be the administration, no matter how, or by what passage into the human organization, of "a destructive article" or "thing," it would still leave us to determine in each case the reality of the destructiveness required in the "thing" proved to have been employed. In short, no single form of words would seem to comprise enough to relieve us of the doubt in many cases that must now and then occur.—H.]

It will be perceived that the words of the statute leave the question "what is a poison" to depend upon the medical evidence adduced. In a trial which took place lately at the Chelmsford Assizes, a woman was charged with administering *white precipitate* to her husband with intent to kill. She was acquitted on the ground that there was no evidence to show that white precipitate was either a poison or a destructive thing. It is, however, placed beyond doubt that this substance is not only capable of producing noxious effects, but of destroying human life; hence, this acquittal was based on a pure mistake. White precipitate is not by any means so poisonous as corrosive sublimate, but it is undoubtedly a mercurial poison. *White hellebore* has been pronounced not to be a poison under similar circumstances; and, in fact, unless the medical evidence received by a court when this question is raised, is very closely investigated, the greatest mistakes may arise, owing, perhaps, to want of experience or want of reflection on the part of those to whom the question is put.

The quantity of a poisonous substance found in an article of food does not affect the culpability of a person indicted for administering it. In the case of *Hartley* (C.C.C. May 12, 1850) in which an attempt was made to administer sulphuric acid mixed with coffee, Mr. Justice Cresswell stated—if poison be administered with intent to murder, it is not necessary there should be enough in the article administered to cause death. If any poison be there, and the intent be proved, the crime of attempting to administer poison is complete. In the case of *Reg.* v. *Southgate* (Chelmsford Lent Assizes, 1849,) Baron Parke said in reply to an objection taken, it was quite immaterial to define or prove in what vehicle a poison was given, or whether it was administered in a solid or liquid form.

This question, "What is a poison," may present itself under another aspect. In The *Queen* v. *Cluderay* (Exchequer Chamber, January 19, 1849,) the prisoner was indicted for administering poison with intent to murder. He was proved to have administered to a child, nine weeks old, two berries in the husk of Coccolus Indicus, and the berries passed through the body of the child without doing any injury. It was submitted for the prisoner, that being in the husk, they could not be considered a poison. The point was reserved by Mr. Justice Williams, who tried the case at York. It was now contended for the prisoner, that although the kernel of this nut was poison, still, having been given in the husk, which was hard of digestion, it could not be considered an administering of poison within the statute 1 Vict. c. 85. The Chief-Justice said the Court was of opinion that where a man administered something that was poison, with intent to murder, but in such a way that it did not act, he was guilty. Conviction affirmed. This is the only reasonable view to take of such an objection. The seed contains the poison, but the husk is inert: nevertheless the berry must be regarded as a poison.

Mechanical Irritants.—Such, however, is the present state of the law of England in respect to attempts at poisoning when death does not take place. While the words of the statute render it unnecessary for a medical witness, in such cases, to give judicially a very close definition of a "poison," they impose upon him a difficulty which he must be prepared to meet. The substance administered may not be a poison in the medical signification of the term, and it may not be popularly considered as such; yet when taken it may be destructive to life. We have examples of substances of this description in iron filings, powdered glass, sponge, pins and needles, and such like bodies, all of which have been administered with the wilful design of injuring, and have on various occasions given

rise to criminal charges. In cases of this kind, the legal guilt of a prisoner may often depend on the meaning assigned by a medical witness to the words *destructive thing*. Thus, to take an example, liquid mercury might be poured down the throat of a young infant, with the deliberate attempt to destroy it. A question of a purely medical nature will then arise whether mercury be "a destructive thing" or not; and the conviction of the prisoner will probably depend on the answer returned by the witnesses. Should a difference of opinion exist,—an occurrence by no means unusual in medical evidence, the prisoner will, according to the humane principle of our law, receive the benefit of the doubt.

Among the singular methods resorted to for the purpose of destroying the lives of infants and children, that of causing them to swallow *pins* or *needles* in their food is one which claims the attention of medical jurists. This mode of attempting murder has been brought to light by the evidence given on several criminal trials, which have taken place of late years in England and on the continent. In cases of this kind, death is commonly to be referred to inflammation; and a practitioner can have no hesitation in designating these bodies, when exhibited to young children, as "destructive things." They are at all times likely to lead to serious injury if not to death; nor is it any answer to this view to assert, that they have been often swallowed with impunity. We know that active poisons are sometimes taken without causing death; but this does not alter our opinion, that they are substances destructive to life, and likely to give rise to the most serious consequences.

Influence of Habit on Poisons.—Habit, it is well known, diminishes the effect of certain poisons:—thus it is that opium, when frequently taken by a person, loses its effect after a time, and requires to be administered in a much larger dose. Indeed, confirmed opium-eaters have been enabled to take, at once, a quantity of the drug which would have infallibly killed them, had they commenced with it in the first instance. Even infants and young children, who are well known to be especially susceptible of the effects of opium, and are liable to be poisoned by very small doses, may, by the influence of habit, be brought to take the drug in very large quantities. This is well illustrated by a statement made by Mr. Grainger, in the Report of the Children's Employment Commission. It appears that the system of drugging children with opium in the Factory districts commences as soon after birth as possible; and the dose is gradually increased until the child takes from fifteen to twenty drops of laudanum at once! This has the effect of throwing it into a lethargic stupor. Healthy children of the same age would be killed by a dose of five drops. Dr. Christison has remarked that this influence of habit is chiefly confined to poisons derived from the organic kingdom; and I quite agree with him in thinking that the stories related of arsenic-eaters, and corrosive sublimate-eaters, are not to be credited. There is no proof that any human being has ever accustomed himself, by habit, to take these substances in doses that would prove poisonous to the generality of adults. I have only met with one fact which appears adverse to this opinion. M. Flandin states that he gave to animals doses of arsenious acid in powder, commencing with 1-65th of a grain mixed with their food; and that in nine months, by progressive increase, they bore a dose of upwards of fifteen grains of arsenious acid, in powder, in twenty-four hours, without their appetite or health becoming affected! (Traité des Poisons, i. 737.) This is contrary to all experience in the medicinal use of arsenic in the human subject; for, as it will be seen hereafter (see ARSENIC,) a very slight increase of a medicinal dose has often been attended with such alarming symptoms as to render a discontinuance of the medicine absolutely necessary to the safety of the person. The only form in which I have known the question of habit to be raised in medical jurisprudence is this: whether, while the more prominent effects of a poison are thereby diminished, the insidious or latent effects on the constitution are at the same time counteracted. The answer is of some importance in relation to the subject of life-insurance:—for the concealment

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of the practice of opium-eating by an insured party has already given rise to an action in which medical evidence on this subject was rendered necessary. As a general principle, we must admit that habit cannot altogether counteract these insidious effects of poisons; but that the practice of taking them is liable to give rise to disease or impair the constitution.

[The practice of drugging infants with preparations of opium is only too common in this country, although there is no evidence of its having been carried to the frightful extent described in the manufacturing towns of England. We have heard of as much as a tea-spoonful of laudanum having been given, without apparently serious effects, to a child under five years of age, and of other fabulously large quantities being given with supposed impunity by mothers and nurses in the rural districts and the suburbs of our city. The tinctures employed on these occasions were doubtless materially diluted, as they are very apt to be at the low price for which they are generally sold by the country and suburban shop keepers, and, therefore, do not afford a fair criterion of the tolerance of the narcotic in the different cases. The frequent dilution and want at least of uniformity of strength of the laudanum and paregoric used reminds us of a source of fatal accident arising from the administration of a preparation of officinal strength where an inferior article had been habitually indulged in. An instance of this kind was brought to our notice some years ago in a neighbouring city. An old woman who had accustomed herself to tablespoonful drams of the spurious laudanum for sale in her immediate vicinity, was so unfortunate as to meet with some of her favourite liquor that had been prepared by a respectable apothecary; and upon taking the usual amount was thrown into a coma that soon ended with her life.

In relation to the "arsenic-eaters" whose existence is so entirely discredited by Mr. Taylor, we cannot help thinking that the evidence of their reality is unhappily too strong to be resisted on merely theoretical grounds. (See Am. Journ. Med. Sci., July, 1852, 270; also, L'Officine of Dorvault, who cites the *Gazette Medicale de Vienne.*) We refer to it especially in order to call attention to the fact that within the last ten years the consumption of arsenic and opium, or the demand for them, among wholesale druggists, on the part of country dealers, has remarkably increased in Philadelphia. We are not aware that this increased demand exists in other large cities of the Union, or is confined to the merchants of any particular part or parts of the country, or that it comes from any one class of our countrymen; nor have we been able to discover to what uses, other than the ordinary applications, the arsenious acid, thus distributed throughout the land, is professed to be applied. The whole inquiry, however, is now in the hands of a committee of the American Pharmaceutical Association, (see Am. Jour. Pharm. for Jan. 1853, 87,) whose researches will doubtless enable them to throw a great deal of important light upon the subject; and, at all events, to furnish the necessary data which our sources of information have not enabled us to reach. The object of this committee is to bring about a much needed reform in the sale of poisons generally. We sincerely hope they will make it a permanent and speedy one.—H.]

Influence of Idiosyncrasy.—Idiosyncrasy differs from habit:—it does not, like this last, diminish the effect of a poison; for it is not commonly found that any particular state of the body is a safeguard against the effects of these powerful agents. Some constitutions are observed to be much more affected than others by certain poisons:—Thus opium, arsenic, and mercury, are substances of this description, and this difference in their effects is ascribed to idiosyncrasy. Dr. Christison mentions a remarkable instance, in which a gentleman unaccustomed to the use of opium, took nearly an ounce of good laudanum without any effect. (On Poisoning, 33.) This form of idiosyncrasy is very rare. Certain substances, generally reputed harmless, and, indeed, used as articles of food, are observed to affect some persons like poisons. This is the case with pork, certain kinds of

shell-fish, and mushrooms. There may be nothing poisonous in the food itself; but it acts as a poison in particular constitutions:—whether from its being in these cases a poison *per se*, or rendered so during the process of digestion, it is difficult to say. The subject of idiosyncrasy is of great importance in a medico-legal view, when symptoms resembling those of poisoning follow a meal consisting of a particular kind of food. In such a case, without a knowledge of this peculiar condition, we might hastily attribute to poison effects which were really due to another cause. It would appear that in some instances idiosyncrasy may be acquired—*i. e.* a person who at one period of his life had been in the habit of partaking of a particular kind of food, may find at another period that it will disagree with him. When pork has been disused as an article of diet for many years, it cannot always be resumed by individuals with impunity. When the powers of life have become enfeebled by age, the susceptibility of the system to poisons is increased; thus aged persons may be killed by comparatively small doses of arsenic and opium. Cases of acquired idiosyncrasy are very rare; it appears to be, if we may so apply the term, a congenital condition.

CLASSIFICATION OF POISONS.—Poisons may be divided into three classes, according to their mode of action on the system; namely, IRRITANTS, NARCOTICS, and NARCOTICO-IRRITANTS. This classification is a modification of that originally proposed by Orfila, and is almost universally adopted by toxicologists.

Irritants.—The irritants are possessed of these common characters. When taken in ordinary doses, they occasion speedily violent vomiting and purging. These symptoms are either accompanied or followed by an intense pain in the abdomen. The peculiar effects of the poison are manifested chiefly on the stomach and intestines, which, as their name implies, they irritate and inflame. Many substances belonging to this class of poisons possess corrosive properties; such as the strong mineral acids, caustic alkalies, bromine, corrosive sublimate, and others. These, in the act of swallowing, are commonly accompanied by an acrid or burning taste, extending from the mouth down the œsophagus to the stomach. Some irritants do not possess any corrosive action,—of which we have examples in arsenic, the poisonous salts of barytes, carbonate of lead, cantharides, &c., and these are often called pure irritants. They exert no destructive chemical action on the tissues with which they come in contact; they simply irritate them.

Difference between Corrosive and Irritant Poisons. There is this difference between CORROSIVE and IRRITANT poisons. Under the action of corrosive poisons, the symptoms are commonly manifested immediately, because mere contact produces disorganization of a part, usually indicated by some well marked symptoms. In the action of the purely irritant poisons, the symptoms are generally more slowly manifested, rarely showing themselves until at least half an hour has elapsed from the time of swallowing the substance. Of course, there are exceptions to this remark; for sometimes irritants act speedily, though seldom with the rapidity of corrosive poisons. It is important, in a practical view, to distinguish whether, in an unknown case, the poison which a person, requiring immediate treatment, may have swallowed, be irritant or corrosive. This may be commonly determined by the answer to the question, as to the time at which the symptoms appeared after the suspected poison was taken. In this way we may often easily distinguish between a case of poisoning from arsenic and one from corrosive sublimate. There is also another point which may be noticed. As the corrosion is due to a decided chemical action, so the examination of the mouth and fauces may enable us in some cases to determine the nature of the poison swallowed.

It has been already stated that there are many irritant poisons which have no corrosive properties, and, therefore, never act as corrosives; but it must be remembered that every corrosive may act as an irritant. Thus the action of corrosive sublimate is that of an irritant poison, as, while it destroys some parts of

the coats of the stomach and intestines, it irritates and inflames others. So again, most corrosive poisons may lose their corrosive properties by dilution with water, and then they act simply as irritants. This is the case with the mineral acids, and bromine. In some instances, it is not easy to say whether an irritant poison possesses corrosive properties or not. Thus oxalic acid acts immediately, and blanches and softens the mucous membrane of the mouth and fauces, but I have never met with any decided marks of what could be called chemical corrosion produced by it in the stomach or viscera. Irritant poisons, for the most part, belong to the mineral kingdom; and they may be divided into the non-metallic and metallic irritants. There are a few derived from the animal and vegetable kingdom; but these are not very often employed criminally. Some of the gases likewise belong to the class of irritant poisons.

Narcotic Poisons.—Narcotic poisons have their operation confined to the brain and spinal marrow. Either immediately or some time after the poison has been swallowed, the patient suffers from cephalalgia, vertigo, paralysis, coma, and in some instances tetanus. They have no acrid burning taste like the corrosive irritants; and they very rarely give rise to vomiting or diarrhœa. When these symptoms follow the ingestion of the poison into the stomach, the effect may be generally ascribed either to the quantity in which the poison has been taken, and the mechanical effect on the stomach thereby produced, or to the poison being combined with some irritating substance, such as alcohol. The pure narcotics are not found to irritate or inflame the viscera.

Notwithstanding the well defined boundary thus apparently existing between these two classes of poisons, it must not be supposed that each class of bodies will always act in the manner indicated. Some irritants have been observed to affect the brain or the spinal marrow remotely. This is the case with oxalic acid and arsenic. Both of these common poisons have in some instances given rise to symptoms closely resembling those of narcotic poisoning; namely, coma, paralysis, and tetanic convulsions. In a case of poisoning by arsenic which occurred to Dr. Morehead, of Bombay, the symptoms of narcotism were so strongly marked that it was believed at first that the man had taken a narcotic. (Med. Gaz. vol. xliii. p. 1055.) I have met with one case of poisoning by arsenic in which there was paralysis of the extremities, with an entire absence of purging, during the eight days which the deceased survived. On the other hand, in the chapter on opium, a case of poisoning by a large dose of this drug will be found related, in which there was an absence of the usual symptoms of cerebral disturbance, and the presence of others resembling those of irritant poisoning—namely, pain and vomiting. Thus, then, we must not allow ourselves to be deceived by the idea that the symptoms are always clearly indicative of the kind of poison taken. The narcotic poisons are few in number, and belong to the vegetable kingdom. Some of the poisonous gases possess a narcotic action.

Narcotico-Irritants.—Poisons belonging to this class have, as the name implies, a compound action. They are chiefly derived from the vegetable kingdom. At variable periods after they have been swallowed they give rise to vomiting and purging like irritants; and sooner or later produce stupor, coma, paralysis and convulsions, owing to their effect on the brain and spinal marrow. They possess the property, like irritants, of irritating and inflaming the alimentary canal. As familiar examples we may point to nux vomica, monkshood, and poisonous mushrooms. This class of poisons is very numerous, embracing a large variety of well known vegetable substances; but they rarely form a subject of difficulty to a medical practitioner. The fact of the symptoms occurring after a meal at which some of the suspicious vegetables may have been eaten, coupled with the nature of the symptoms themselves, will commonly indicate the class to which the poison belongs. Some narcotico-irritants have a hot acrid taste, such as the aconite or monkshood; others, an intensely bitter taste, as nux vomica and its alkaloid, strychnia.

CHAPTER II.

EVIDENCE OF POISONING IN THE LIVING SUBJECT—SYMPTOMS OCCUR SUDDENLY—MODIFYING CONDITIONS—ACTION OF POISONS INCREASED OR DIMINISHED BY DISEASE—SYMPTOMS CONNECTED WITH FOOD OR MEDICINE—SUDDEN DEATH FROM NATURAL CAUSES MISTAKEN FOR POISONING—SEVERAL PERSONS ATTACKED SIMULTANEOUSLY—EVIDENCE FROM THE DETECTION OF POISON IN FOOD.

We shall next proceed to consider the evidence of poisoning in the *living* subject. To the practitioner the diagnosis of a case of poisoning is of very great importance, as by mistaking the symptoms produced by a poison for those arising from natural disease, he may omit to employ the remedial measures which have been found efficacious in counteracting its effects, and thus lead to the certain death of the patient. To a medical jurist a correct knowledge of the symptoms furnishes the chief evidence of poisoning, in those cases in which persons are charged with the criminal administration of poison with intent to murder, but from the effects of which the patient ultimately recovers. The symptoms produced during life constitute also an important part of the evidence, in those instances in which the poison proves fatal. At present, however, we will suppose the case to have been, that poison has been taken and the patient survives. Most toxicological writers have laid down certain characters whereby it is said symptoms of poisoning may be distinguished from those of disease.

1. *In poisoning, the symptoms appear suddenly, while the individual is in health.*—It is the common character of most poisons, when taken in the large doses in which they are usually administered with criminal intent, to produce serious symptoms either immediately or within a very short period after they have been swallowed. Their operation, under such circumstances, cannot be suspended, and then manifest itself after an indefinite interval; although this was formerly a matter of universal belief, and gave rise to many absurd accounts of what was termed *slow* poisoning.

The symptoms of poisoning by prussic acid, oxalic acid, or strychnia, appear immediately, or within a very few minutes after the poison has been swallowed. In one case, however, where the dose of prussic acid was small, and insufficient to produce death, the poison was supposed by the patient not to have begun to act until after the lapse of fifteen minutes. (Ed. Med. and Surg. Journ. lix. 72.) The symptoms caused by arsenic and other irritants, and, indeed, by all poisons generally, are commonly manifested in from half an hour to an hour. It is rare that the appearance of symptoms is protracted for two hours, except under certain peculiar states of the system. It is said that some narcotico-irritant poisons, such as the poisonous mushrooms, may remain in the stomach twelve or twenty-four hours without giving rise to symptoms; and this is also affirmed to be the case with some animal irritants, such as decayed meat; but with regard to the first point, it has been shown by Dr. Peddie that mushrooms may produce symptoms in half an hour; and a case has fallen under my own observation, where the symptoms from noxious food came on within as short a time after the meal as is commonly observed in irritant poisoning by mineral substances. In cases of poisoning by phosphorus, the symptoms do not commonly begin until after the lapse of many hours.

Modifying conditions. Influence of disease.—A *diseased* state of the body may render a person comparatively unsusceptible of the action of some poisons, while in other instances it may increase their action, and render them fatal in small doses. In dysentery and tetanus, a person will take, without being materially affected, a quantity of opium sufficient to kill an adult in average health. Mania,

cholera, hysteria, and delirium tremens, are also diseases in which large doses of opium may be borne with comparative impunity. In a case of hemiplegia, a woman, æt. 29, took, for six days, three grains of strychnia daily without injurious consequences—the dose having been gradually raised (Gaz. Méd. Mai, 1845;) while one grain of strychnia is commonly regarded as a fatal dose to a healthy person. In a case of tetanus, Dupuytren gave as much as two ounces of opium at a dose (60 grammes,) without serious consequences. (Flandin, Traité des Poisons, i. 231.) It has also been remarked that persons affected with tetanus are not easily salivated by mercury. (Colles' Lectures, i. 77.) The effect of certain diseases of the nervous system as well as of habit, either in retarding the appearance of symptoms, or in blunting the operation of a poison, it is not difficult to appreciate; and they are cases which can present no practical difficulty to a medical jurist. On the other hand, in certain diseased states of the system, there is an increased susceptibility of the action of poisons. Thus, in those persons who have a disposition to apoplexy, a small dose of opium may act more quickly and prove fatal. In a person labouring under inflammation of the stomach or bowels, there would be an increased susceptibility of the action of arsenic or other irritants. One of the most remarkable instances of the influence of disease in increasing the operation of poison, is perhaps seen in cases of diseased kidney (granular degeneration,) in which very small doses of mercury have been observed to produce severe salivation, leading to exhaustion and death. A knowledge of this fact is of importance in reference to charges of malapraxis, when death has arisen from ordinary doses of calomel administered to persons labouring under this disease.

Symptoms appear during a state of health.—Symptoms of poisoning often manifest themselves in a person while in a state of *perfect health*, without any apparent cause. This rule is, of course, open to numerous exceptions, because the person on whose life the attempt is made may be actually labouring under disease; and, under these circumstances, the symptoms of poisoning are so obscure as often to disarm all suspicion. When poison is exhibited in medicine, a practitioner is very liable to be deceived, especially if the disease under which the party is labouring be of an acute nature, and attended by symptoms of disorder in the alimentary canal. Several cases of poisoning have occurred within the last few years, where arsenic was criminally substituted for medicine, and given to the parties while laboring under a disorder of the bowels. We are, however, justified in saying with respect to this character of poisoning, that, when in a previously healthy person, violent vomiting and purging occur suddenly, and without any assignable cause, such as disease or indiscretion in diet, to account for them, there is strong reason to suspect that irritant poison has been taken. When the person is already labouring under disease, we must be especially watchful, on the occurrence of any sudden change in the character or violence of the symptoms, unless such change can be easily accounted for on common or well-known medical principles. In most cases of criminal poisoning, we meet with alarming symptoms without any obvious or sufficient natural cause to explain them. The practitioner will of course be aware that there are certain diseases which are liable to occur suddenly in healthy people, the exact cause of which may not at first sight be apparent; therefore this criterion is only one out of many on which a medical opinion should be founded.

2. *In poisoning, the symptoms appear soon after a meal, or soon after some kind of food or medicine has been taken.*—This is by far the most important character of poisoning in the living body. It has been already observed, that most poisons begin to operate within about an hour after they have been swallowed; and although there are a few exceptions to this remark, yet they occur under circumstances easily to be appreciated by a practitioner. Thus, then, it follows, that, supposing the symptoms under which a person is labouring to depend on poison, the substance has most probably been swallowed either in food or medi-

sine, from half an hour to an hour previously. It must be observed, however, that cases of poisoning may occur without the poison being introduced by the mouth. Oil of vitriol has been thrown up the rectum in the form of enema, and caused death: the external application of arsenic, corrosive sublimate, and cantharides, has destroyed life. In one case arsenic was introduced into the vagina of a female, and she died in five days under all the symptoms of arsenical poisoning. (Schneider, Ann. der Ges. Staatsarzneikunde, i. 229.) Such cases are rare, but nevertheless the certainty that they have occurred where their occurrence could hardly have been anticipated, shows that in a suspicious case a practitioner should not deny the fact of poisoning, merely because it is proved that the patient could not have taken the poison in the usual way—by deglutition. Again, persons may be destroyed by the vapours of ether, chloroform, prussic acid, or other powerful volatile poisons, introduced into the system through the lungs. Such a mode of suicide, or murder, might disarm suspicion, from the fact of no noxious material being found in the stomach. An act of Parliament has been recently passed, which makes it felony to administer, or even attempt to administer, poisons in this manner (14 and 15 Vict. c. 19, sec. 111.)

Let us suppose, however, the circumstances to have been such that these secret means of destruction could not have been resorted to, and that the poison is one of those most commonly selected by a murderer, such as arsenic, oxalic acid, or corrosive sublimate, then we may expect that this character of poisoning will be made evident to us, and that something must have been swallowed by the patient shortly before the alarming symptoms appeared. By observations attentively made, it may be in our power to connect the appearance of the symptoms with the use of a particular article of food, and thus indirectly lead to the detection of the criminal. Supposing that many hours have passed since food or medicine was taken by the patient, without any effect ensuing,—it becomes very probable that the symptoms are due to some other cause, and not to poison. The *time of the occurrence of the symptoms* in relation to a particular meal, is then a fact of especial importance in forming an opinion when poisoning is suspected.

Among numerous cases which might be adduced in support of this view, I select the following, which was communicated by Mr. George, of Bath, to the Provincial Journal, (January 24th, 1849.) The patient, a girl æt. 16, was pregnant: she complained of a painful swelling of the leg. On the day of her death she made a hearty dinner of beef, vegetables, and porter, with the family at one o'clock, and remained in the same room where she had partaken of that meal until three o'clock. On quitting the apartment, she began to groan, complained of agony at the pit of the stomach, and became faint: there was vomiting, and in three-quarters of an hour she died. On inspection, there was an inflamed appearance both of the duodenum and stomach. A careful analysis of the viscera, as well as of the matter vomited, revealed no poison; and the fact that no symptoms had occurred during a period of *two hours after the meal*, strongly corroborated the conclusion that the deceased had died from natural causes.

When symptoms resembling those of poisoning speedily follow the ingestion of food or medicine, there is, however, always great room for suspicion; but caution should be observed in drawing inferences, since the most extraordinary coincidences sometimes present themselves. In the celebrated case of *Sir Theodosius Boughton*, who was poisoned by his brother-in-law, Donellan, in 1781, the fact of alarming symptoms coming on in *two minutes* after the deceased had swallowed what was supposed to be a simple medicinal draught, was a most important fact in the evidence against the prisoner. There is no doubt that laurel water had been substituted for the medicine by the prisoner. I may here remark, that the practice of substituting poisonous mixtures for medicinal draughts or powders, is by no means unusual; although it might be supposed to indicate a degree of refinement and knowledge not commonly to be found among the lower classes of criminals. Medical practitioners are thus apt to be imposed upon, and the fol-

lowing case, related by one of our present judges, will serve as a caution. An apothecary prepared a draught, into which another person put poison, intending thereby to destroy the life of the patient for whom the medicine was prescribed. The patient, not liking the taste of the draught, and thinking there was something suspicious about it, sent it back to the apothecary, who, knowing the ingredients of which he had composed it, and wishing to prove to his patient that he had done nothing wrong, drank it himself, and died. He was thus the unconscious agent of his own death; and although the draught was intended for another, the party who poisoned it was held guilty of murder. This case contains a serious warning to medical witnesses. It is not very unusual, on trials for poisoning, when the poison is conveyed through medicine, to find a medical witness offering to swallow his own draught in a court of law, in order to furnish to the court and jury a convincing practical illustration of the innocence of the medicine! I need hardly observe that an exhibition of this kind is never required of a medical witness. The court will receive his deposition, without compelling him to swallow his own medicine, even supposing it to have been secretly poisoned. If any doubt be raised of the innocent properties of a draught, a chemical analysis of its contents will be far more satisfactory, and attended with no kind of risk to the practitioner.

On the other hand, the occurrence of symptoms resembling those produced by poison, soon after food or medicine has been taken, may be a pure coincidence. In such a case, poison is always suspected by the vulgar; and it will be the duty of a medical jurist to guard against the encouragement of such a suspicion, until he has strong grounds to believe it to be well founded. No public retraction or apology can ever make amends for the injury which may in this way be inflicted on the reputation of another; for they who hear the accusation may never hear the defence. In all such cases, a practitioner may entertain a suspicion, but he should always avoid *expressing* it, or giving it publicity. When death is not a consequence, it is difficult to clear up such cases, except by the aid of a chemical analysis; but this, as we know, is not always applicable. If death ensues, the real cause is usually apparent, and a suspicion of poisoning is thus often removed by a post-mortem examination.

3. *In poisoning, when several partake at the same time of the same food or medicine (mixed with poison) all suffer from similar symptoms.*—This character of poisoning cannot always be procured; but it furnishes good evidence of the fact when it exists. Thus, supposing after a meal made by several persons from the same dish, only one suffers, the suspicion of poisoning is considerably weakened. The poisoned article of food may be detected by observing whether they who suffer under any symptoms of poisoning have partaken of one particular solid or liquid in common. In a case of accidental poisoning at a dinner-party, a friend of mine observed that those who suffered had taken port-wine only: the contents of the bottle were examined, and found to be a saturated solution of arsenic in wine. In general, considerable reliance may be placed upon this character, because it is very improbable that any common cause of disease should suddenly attack, with violent and alarming symptoms, many healthy persons at the same time, and within a short period after having partaken of food together. We must beware of supposing that, in those cases in which poison is really present, all will be attacked with precisely similar symptoms; because, as we have seen, there are many circumstances which may modify their nature and progress. In general, that person who has partaken most freely of the poisoned dish will suffer most severely, but even this does not always follow. There is a well-known case recorded by Bonnet, where, among several persons who partook of a dish poisoned with arsenic, they who had eaten little and *did not vomit*, speedily died; while others who had partaken largely of the dish, and had in consequence vomited freely, recovered.

It was just now remarked that there is no disease likely to attack several

healthy persons at the same time, and in the same manner. This is undoubtedly true, *as a general principle*, but the following case will show that mistakes may occasionally arise even under these circumstances. It occurred in London, during the prevalence of the malignant cholera in the year 1832. Four of the members of a family living in a state of great domestic unhappiness, sat down to dinner in apparently good health: some time after the meal, the father, mother, and daughter, were suddenly seized with violent vomiting and purging. The stools were tinged with blood, while the blueness of the skin, observed in cases of malignant cholera, was wanting. Two of the parties died. The son, who was known to have born ill-will against his father and mother, and who suffered no symptoms on this occasion, was accused of having poisoned them. A strict investigation took place before the coroner; but it was clearly shown by the medical attendant that the deceased persons had really died of the malignant cholera, and there was no reason whatever to suspect that any poison had been administered to them. In this instance, it will be perceived that symptoms resembling those of irritant poison appeared suddenly in several individuals in perfect health, and shortly after a meal. We hereby learn that the utility of any rules for investigating cases of poisoning depends entirely on the judgment and discretion with which they are applied to particular cases.

It is well to bear in mind, in conducting these inquiries, that symptoms resembling those produced by irritant poison may be sometimes due to the description of *food* which may have been taken at the meal. Besides flesh rendered unwholesome from disease and decay, there are certain kinds of shell-fish, as well as pork, bacon, sausages, cheese, and bread, which, under certain circumstances, may give rise to formidable symptoms, and even death. In such a case, all the foregoing characters of poisoning are brought out; and, indeed, the case may be regarded as one of poisoning by an animal or vegetable irritant. The diagnosis is difficult; and great ambiguity frequently arises, from the fact that not more than one or two individuals may be affected, who have frequently before partaken of the same kind of food without any particular inconvenience.

4. *The discovery of poison in the food taken, or in the matters vomited.*—One of the best proofs of poisoning in the living subject is the detection of poison by chemical, or if of a vegetable nature, by microscopical analysis, either in the food taken by the person labouring under its effects, or in the matters vomited. The evidence is of course more satisfactory when the poison is detected in the matters vomited, than in the food; because this will show that the poison has really been taken, and will readily account for the symptoms. If the vomited matters have been thrown away, we must then examine the food of which the patient may have partaken. Should the results in both cases be negative, the probability is, that the symptoms may have been due to disease.

In investigating a case of poisoning in the living subject, a medical jurist must remember that poisoning is sometimes *feigned*, and at others *imputed*. It is very easy for an artful person to put poison into food, as well as to introduce it into the matters vomited or discharged from the bowels, and to accuse another of having administered it. There are few of these accusers who go so far as to swallow poison under such circumstances, there being a great dread of poisonous substances among the lower orders; and it will be at once apparent, that it would require a person well versed in toxicology to feign a series of symptoms which would impose upon a practitioner at all acquainted with the subject. In short, the difficulty reduces itself to this:—What inference can we draw from the chemical detection of poison in food? All that a medical man can do, is to say whether poison be present or not in a particular article of food:—he must leave it to the authorities of the law to develope the alleged attempt at administration:—but if the poison have been actually administered, then we should expect to find the usual symptoms. The absence of these symptoms would be a very strong fact against the alleged administration. With regard to the detection of poison in the

matters vomited from the stomach, this affords no decisive proof that it has been swallowed, except under two circumstances:—1. When the accuser really labours under the usual symptoms of poisoning, in which case there can be no feigning, and the question of imputation is a matter to be established by general evidence. 2. When the matters are actually vomited into a *clean vessel* in the presence of the medical attendant himself, or of some person on whose testimony perfect reliance can be placed.

CHAPTER III.

ON THE EVIDENCE OF POISONING IN THE DEAD BODY—PERIOD AT WHICH POISONS PROVE FATAL—CHRONIC POISONING—POST-MORTEM APPEARANCES PRODUCED BY THE DIFFERENT CLASSES OF POISONS—REDNESS OF THE MUCOUS MEMBRANE MISTAKEN FOR INFLAMMATION—ULCERATION AND CORROSION—SOFTENING—PERFORATIONS OF THE STOMACH FROM POISON AND DISEASE.

SUPPOSING that the person is dead, and we are required to determine whether the case be one of poisoning or not, we must, in the first instance, endeavour to ascertain all the particulars which have been discussed in the last chapter, as indicative of poisoning in the living subject. Should the deceased have died from poison, the circumstances of the attack, and the symptoms preceding death, ought to correspond with the characters already described; and in these investigations it is well to bear in mind the following rule:—There is no one symptom or pathological condition which is peculiar to poisoning; but at the same time there is no disease which presents *all* those characters which are met with in a special case of poisoning. [Dr. G. reminds us that the evidence of medical men is frequently required to determine whether the deceased came to his death by poison, or from some other cause. (See 1 *McNally*, 329–335.) When this evidence is given, the facts on which the opinion is grounded must be stated. (*Dickerson* v. *Barker*, 9 *Mass. Rep.* 245.)—H.] The additional evidence to be derived from the *death* of the person may be considered under the following heads:—

1. *The time at which death takes place after the first occurrence of symptoms.*—This question it is necessary to examine, because the more common poisons, when taken in fatal doses, generally produce their fatal effects within certain periods of time. By an attention to this point, we may, in some instances, be enabled to negative a charge of poisoning, and in others to form an opinion of the kind of poison which has been taken. In a court of law, a medical practitioner is often required to state the usual *period of time* within which poisons prove fatal. It is to be observed that not only do poisons differ from each other in this respect, but the same substance, according to the form or quantity in which it has been taken, will differ in the rapidity of its action. A large dose of prussic acid, *i. e.* from half an ounce to an ounce, may destroy life in less than two minutes. In ordinary cases of poisoning by this substance a person dies, *i. e.* all signs of life have commonly ceased, in from ten to twenty minutes:—if he survive half an hour, there is some hope of recovery. In the cases of the seven Parisian epileptics, accidentally poisoned by this acid, the first died in about twenty minutes, the seventh survived three quarters of an hour.—(See post, PRUSSIC ACID.) Oxalic acid, one of the most energetic of the common poisons, when taken in a dose of from half an ounce to an ounce, may destroy life in from ten minutes to an hour: if the poison be not perfectly dissolved when swallowed, it is a longer time in proving fatal. The strong mineral acids, in poisonous doses, destroy life in about eighteen or twenty-four hours. Arsenic, under the form of arsenious acid (white arsenic,) operates fatally in from eighteen hours to three

or four days. It has, however, in more than one instance, killed a person in two hours, although this is by no means common. Opium, either as a solid or under the form of laudanum, commonly proves fatal in from six to twelve hours; but it has been known, in several instances, to destroy life in less than three hours: they who survive the effects of this poison for twelve hours are considered to have a fair chance of recovery. This must be understood to be merely a statement of the average results, as nearly, perhaps, as we are warranted in giving an opinion; but the medical jurist will of course be aware that the fatal period may be protracted or shortened, according to all those circumstances which have been elsewhere stated to affect the action of poisons.

There are various forms which this question may assume in a court of law:—the death of a party, alleged to have taken poison, may have occurred too rapidly or too slowly to justify a suspicion of poisoning. The following case may serve as an illustration:—A woman of the name of *Russell* was tried and convicted at the Lewes Summer Assizes, in 1826, for the murder of her husband, by poisoning him with arsenic. The poison was detected in the stomach; but the fact of poisoning was disputed by some medical witnesses, for this among other reasons —that the deceased had died *three* hours after the only meal at which the poison could have been administered to him. The authority of Sir A. Cooper and others, was cited to show, that, according to their experience, they had never known a case to prove fatal in less than seven hours. This may have been; but, at the same time, there was sufficient authority on the other side, to establish that some cases of arsenical poisoning had actually proved fatal in three or four hours. So far as this objection was concerned, the prisoner was very properly convicted.

On the medical question raised at this trial, I may observe, that within the last few years, two distinct cases have occurred where the individuals died certainly within *two hours* after taking arsenic; and several instances have been reported since the trial, in which death took place in from three to four hours after the administration of this poison. It seems extraordinary in the present day, that any attempt should have been made by a professional man to negative a charge of criminal poisoning upon so weak a ground as this; but we must remember that this opinion was expressed many years ago, when the subject of toxicology was but little understood. It is quite obvious that there is nothing, so far as we know, to prevent arsenic from destroying life in an hour. A case will be hereafter related, in which death took place from arsenic most probably in half an hour. These matters can only be settled by a careful observation of numerous cases, and not by any *à priori* reasoning, or reference to individual experience.

In all instances of sudden death, there is generally a strong tendency on the part of the vulgar to suspect poisoning. They never can be brought to consider, that persons may die a natural death *suddenly*, as well as slowly; or, as we shall presently see, that death may really take place slowly, as in cases of disease, and yet be due to poison. This prejudice continually gives rise to the most unfounded suspicions of poisoning. One of the means recommended for distinguishing narcotic poisoning from apoplexy or disease of the heart, is the difference in the rapidity with which death takes place. Thus, apoplexy or disease of the heart may prove fatal either instantly or within an hour. The only common poison likely to operate with such fatal rapidity is prussic acid. Poisoning by opium is commonly protracted for five or six hours. This poison has never been known to destroy life instantaneously, or in a few minutes. Thus, then, it may happen, that death will occur with such rapidity as to render it impossible under the circumstances to attribute it to narcotic poison.

Chronic poisoning.—When a poison destroys life rapidly, it is called a case of *acute* poisoning, to distinguish it from the *chronic* form, *i. e.* where death takes place slowly. Chronic poisoning is not a subject which often requires medico-legal investigation. Most poisons, when their effects are not rapidly manifested,

owing either to the smallness of the dose or to timely treatment, are capable of slowly undermining the powers of life, and killing the patient by producing emaciation and exhaustion. This is sometimes observed in the action of arsenic and corrosive sublimate, but it has been remarked also in cases of poisoning by the mineral acids and caustic alkalies. Death is here an indirect consequence:—in poisoning by the acids or alkalies, either stricture of the œsophagus is induced, or the lining membrane of the stomach is destroyed and the process of digestion impaired,—a condition which leads to emaciation and death. The time at which these indirect effects may prove fatal, is of course liable to vary. A person has been known to die from a stricture of the œsophagus, brought on by sulphuric acid, *eleven months* after the poison was swallowed; and there is no reason to doubt that instances may occur of a still more protracted nature. In these cases of *chronic poisoning* there is considerable difficulty in assigning death exclusively to the original action of the poison, since the habits of life of the party, a tendency to disease, and other circumstances, may have concurred to accelerate or produce a fatal result. To connect a stricture of the œsophagus with the act of poisoning by a mineral acid, it is necessary to show that there was no tendency to this disease before the acid was administered:—that the symptoms appeared soon after the first effects of the poison went off:—that these symptoms continued to become aggravated until the time of death:—and that there was no other cause, to which death could with any probability be referred. These remarks apply equally to the indirectly fatal effects of any poison,—such, for instance, as the salivation occasionally induced by corrosive sublimate, when the acute symptoms of poisoning by this substance have passed away. It has been stated, that chronic poisoning is not a subject commonly requiring a criminal investigation. Two cases have, however, come before our tribunals, in which the facts connected with this form of poisoning, were of some importance. I allude to those of *Miss Blandy*, tried at Oxford, in 1752, for the murder of her father by arsenic; and of a woman named *Butterfield*, tried at Croyden, in 1775, for the murder of a Mr. Scawen, by administering corrosive sublimate. In most cases, murderers destroy life by administering poison in very large doses; but in the instances referred to, small doses were given at intervals,—a fact which led to great medical doubt of the real cause of the symptoms before death. It is, however, very rare to hear of this form of criminal poisoning.

2. *Evidence from post-mortem appearances.*—One of the chief means of determining whether a person has died from poison, is an examination of the body after death. In relation to *external* appearances, there are none indicative of poisoning upon which we can safely rely. It was formerly supposed that the bodies of persons who were poisoned putrefied more readily than those of others who had died from natural disease; and evidence for or against poisoning, was at one time derived from the external appearance of the body. This is now known to be an error: the bodies of persons poisoned are not more rapidly decomposed, *cæteris paribus*, than those of others who have died a sudden and violent death from any other cause whatever.

Irritant poisons act chiefly upon the stomach and intestines, which they irritate, inflame, and corrode. We may likewise meet with all the consequences of inflammation, such as ulceration, perforation, and gangrene. Sometimes the coats of the viscera are thickened, at other times thinned and softened, by the action of an irritant.

Narcotic poisons do not commonly leave any well marked post-mortem appearances. The stomach and intestines present no unnatural changes. There is greater or less fulness of the cerebral vessels; but even this is often so slight as to escape notice, unless attention be particularly directed to the brain. Extravasation of blood is rarely found.

The *Narcotico-irritants* affect either the brain or the alimentary canal, and commonly both, according to their peculiar mode of action.

It is important to bear in mind, that both Irritants and Narcotics may destroy life without leaving any appreciable changes in the body. To such cases as these, the remarks about to be made do not apply. The proofs of poisoning must, then, be procured entirely from other sources. Any evidence derivable from the appearances in the body of a person poisoned, will be imperfect unless we are able to distinguish them from those analogous changes often met with as the results of ordinary disease. These are confined to the mucous membrane of the stomach and bowels. They are redness, ulceration, softening, and perforation. Each of these conditions may depend upon disease, as well as upon the action of irritant poisons.

Redness.—It is a main character of the irritants to produce redness of the mucous membrane of the stomach and small intestines. This redness, when first seen, is usually of a deep crimson colour, becoming brighter by exposure to air. It may be diffused over the whole mucous membrane:—at other times it is seen in patches, dots, or lines (striæ,) spread irregularly over the surface of the stomach. It is sometimes met with at the smaller, but more commonly at the larger extremity of this organ; and again, we occasionally find that the rugæ or prominences only of the mucous membrane present this red or inflamed appearance. Redness of the mucous membrane may, however, be due to gastritis or gastro-enteritis; and in order to assign the true cause of the inflammation, it will be necessary to have an account of the symptoms preceding death, or some chemical proof of the existence of irritant poison in the contents of the stomach or the tissues of the body.

In the healthy state, the mucous membrane of the stomach is pale and white, or nearly so, except during digestion, when it becomes slightly reddened; and some observers have remarked that a slight redness has often remained in the stomachs of those who have died during the performance of the digestive process. When in contact with the spleen or liver, after death, the stomach is apt to acquire a deep livid colour from the transudation of blood; and it is well known that the bowels acquire a somewhat similar colour from the gravitation of blood, which always takes place after death. None of these appearances are likely to be mistaken for the action of an irritant poison.

There is an important class of cases in which redness of the mucous membrane of the stomach is found after death, not dependent on the action of poison or on any assignable cause. These cases, owing to their being so little known, and involved in much obscurity, deserve great attention from the medical jurist, since the appearances closely resemble those produced by irritant poison. A person may die without suffering from any symptoms of disordered stomach; but, on an inspection of the body, a general redness of the mucous membrane of this organ will be found, not distinguishable from the redness which is so commonly seen in arsenical poisoning. Several cases of this kind have occurred at Guy's Hospital; and drawings have been made of the appearance presented by the stomach, and are now preserved in the museum collection.

The redness of the stomach, in cases of poisoning, is so speedily altered by putrefaction, when circumstances are favourable to this process, as to render it impossible for a witness to speak with any certainty upon its cause. Putrefactive infiltration from the blood contained in the adjacent viscera and muscles, will give a reddish-coloured appearance to a stomach otherwise in a healthy condition. Great dispute has arisen respecting the length of time during which redness of the stomach produced by an irritant, will be recognisable and easily distinguishable from putrefactive changes. It is, perhaps, sufficient to say, that no certain rule can be laid down on the subject: it must be left to the knowledge and direction of the witness. I have distinctly seen the well marked appearances of inflammation produced by arsenic in the stomach and duodenum, in an exhumed body twenty-eight days after interment (*Reg.* v. *Jennings*, Berks Lent Ass. 1845;) and in another instance, referred to me by Mr. Lewis, the coroner for

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Essex, in August, 1846, the reddened state of the mucous membrane, in a case of arsenical poisoning, was plainly perceptible, on removing a layer of arsenic, *nineteen months* after interment. (See, on this question, a case of suspected poisoning, by Orfila, Annales d'Hyg. 1839, i. 127.) If, however, there be the least doubt respecting the origin of the discoloration, it would be unsafe to rely upon the appearance as evidence of poisoning, unless poison were detected.

Ulceration.—In irritant poisoning, the stomach is occasionally found ulcerated; but this is, comparatively speaking, a rare occurrence. In such cases the mucous membrane is removed in small distinct circular patches, under the edges of which the poison (arsenic) is often found lodged. Ulceration of the stomach is perhaps a more common result of disease, than of the action of poison. As a consequence of disease, it is very insidious, going on often for weeks together, without giving any indications of its existence, except perhaps slight gastric disturbance, with occasional nausea, vomiting, and loss of appetite. In this case the ulceration is commonly seen in small circumscribed patches. It is worthy of remark, as one means of diagnosis, that ulceration has never been known to take place from arsenic or any irritant poison, until symptoms indicative of irritant poisoning have occurred. In ulceration from disease, the mucous membrane is commonly only reddened in the neighbourhood of the ulcer. In ulceration from poison, the redness is generally diffused over other parts of the stomach, as well as over the duodenum and small intestines. A case, however, occurred in Guy's Hospital, some years ago, in which, with a small circular patch of ulceration near the cardiac opening, the whole mucous membrane was red and injected:—but this singular condition of the stomach, so closely resembling the effects of an irritant poison, was unaccompanied by any marked symptoms of irritation during life. The history of a case previous to death, will thus commonly enable us to determine to what cause the ulceration found may be due. Care must be taken to distinguish ulceration from *corrosion.* Ulceration is a vital process: the substance of a part is removed by the absorbents as a simple result of inflammation. Corrosion, on the other hand, is a chemical action;—the parts are removed by the immediate contact of the poison: they are decomposed: their vitality is destroyed, and they combine with the corrosive matter itself. Ulceration requires time for its establishment, while corrosion is either an instantaneous or a very rapid effect.

Softening.—The coats of the stomach are not unfrequently found so soft as to yield and break down under very slight pressure; and this may be the result either of poisoning, of some spontaneous morbid change in its structure during life, or of the solvent action of the gastric juice after death. As this condition in the stomach, when caused by poison, is commonly produced by those substances only which possess corrosive properties, it follows that in such cases traces of their action will be perceived in the mouth, fauces, and œsophagus. In softening from disease, the change will be confined to the stomach alone, and it is commonly found only at the cardiac extremity of the organ. When softening is really caused by an irritant poison, it is generally attended by other striking and unambiguous marks of its operation. Softening is not to be regarded as a common character of poisoning: it is only an occasional appearance. I have met with a case, in which the coats of the stomach were considerably hardened by sulphuric acid. Softening can never be inferred to have proceeded from poison, unless other well marked changes are present, or unless the poison be discovered in the softened parts. The stomachs of infants have been frequently found softened from natural causes:—such cases could not be mistaken for poisoning, since the history during life,—the want of other appearances indicative of poisoning, and the total absence of poison from the viscera, would prevent such a suspicion from being entertained.

Perforation.—The stomach may become perforated either as a result of poisoning or disease.

Perforation from poisoning.—This may occur in two ways:—1. By corrosion;

2. By ulceration. The perforation by *corrosion* is by far the most common variety of perforation from poisoning. It is occasionally witnessed where the strong mineral acids have been taken, especially sulphuric acid:—the stomach, in such cases, is blackened and extensively destroyed,—the aperture is large, the edges are rough and irregular, and the coats are easily lacerated. The poison escapes into the abdomen, and may be readily detected by chemical analysis. The perforation from *ulceration* caused by irritant poison (arsenic,) is but little known. There are, so far as I know, only three instances on record. In a great number of poisoned subjects examined during many years past at Guy's Hospital, not a single case has occurred. It must, then, be looked upon as a very rare appearance in cases of irritant poisoning.

Perforation from disease.—This is by no means an unusual occurrence. Many cases of this description will be found reported elsewhere. (Guy's Hosp. Rep. No. 8.) It is invariably fatal when it proceeds so far that the contents of the stomach escape into the abdomen; but sometimes the stomach becomes glued to the pancreas during the ulcerative process, and then the individual may recover. Several specimens of this kind of adhesion have been met with in post-mortem inspections. The symptoms from perforation commonly attack the individual suddenly, apparently while enjoying perfect health. Hence these cases may be easily mistaken for those of irritant poisoning. The principal facts observed with regard to this formidable disease are the following:—1. It often attacks young females from eighteen to twenty-three years of age. 2. The preceding illness is extremely slight, sometimes there is merely loss of appetite or capricious appetite, with uneasiness after eating. 3. The attack commences with a sudden and most severe pain in the abdomen, generally soon after a meal. In irritant poisoning, the pain usually comes on gradually, and slowly increases in severity. 4. Vomiting, if it exist at all, is commonly slight, and is chiefly confined to what is swallowed. There is no purging:—the bowels are generally constipated. In irritant poisoning, the vomiting is usually severe, and purging seldom absent. 5. The person dies commonly in from eighteen to thirty-six hours:—this is also the average period of death in the most common form of irritant poisoning, *i. e.* by arsenic;—but in no case yet recorded has arsenic caused perforation of the stomach, within twenty-four hours; and it appears probable that a considerable time must elapse before such an effect could be produced by this or any irritant. 6. In perforation from disease, the symptoms and death are clearly referrible to peritonitis. 7. In the perforation from disease, the aperture is commonly of an oval or rounded form, about half an inch in diameter, situated in or near the lesser curvature of the stomach, and the edges are smooth. The outer margin of the aperture is often blackened, and the aperture itself is funnel-shaped from within outwards, *i. e.* the mucous coat is the most removed, and the outer or peritoneal coat, the least. The coats of the stomach, round the edge of the aperture, are usually thickened for some distance; and when cut, they have almost a cartilaginous hardness. These characters of the aperture will not alone indicate whether it be the result of poisoning or disease; but the absence of poison from the stomach, with the want of other characteristic marks of irritant poisoning, would enable us to say that disease was the cause. Besides, the history of the case during life would materially assist us in our diagnosis. The great risk in all these cases is, that the effects of disease may be mistaken for those of poisoning; for we are not likely to mistake a perforation caused by irritant poison for the result of disease. Notwithstanding the well marked differences above described, it is very common to meet with cases of imputed poisoning where death has really occurred from peritonitis following perforation. Within a recent period I have had to examine several cases of this kind: one of them will be found elsewhere recorded (Guy's Hosp. Reports, Oct. 1850, page 226.) In another the body was exhumed after several months' burial, and the stomach was found perforated from disease in the usual situation.

Spontaneous or Gelatinized Perforation.—The stomach is occasionally subject to a spontaneous change, by which its coats become softened and give way, generally at the cardiac extremity. As the extravasation of the contents of the organ in such a case never gives rise to peritoneal inflammation, and no symptoms occur prior to death to indicate the existence of so extensive a destruction of parts, it is presumed to be a post-mortem change, and the stomach is supposed to undergo a process of solution soon after death. It is commonly attributed to the solvent action of the gastric juice,—the spleen, diaphragm, and other viscera being sometimes softened. (For some remarks on this subject, by Dr. Budd, see Med. Gaz. vol. xxxix. p. 895.) In January, 1845, I met with an instance of this perforation in a child between two and three years of age. It was seized with convulsions, became insensible, and died twenty-three hours afterwards. After death, the cardiac end of the stomach was found destroyed to the extent of three inches, and the edges were softened and blackened. There was no food in the stomach, nor had any thing passed into the organ for thirty-two hours before death! It was therefore impossible to ascribe death to the perforation, or the perforation to poison. (For a full account of this case, see Med. Gaz. vol. xxxvi. p. 32.) The inspection of the body, with the general history of the case, will commonly suffice to remove any doubt in forming an opinion as to whether the extensive destruction commonly met with has or has not arisen from poison. Thus, in a post-mortem perforation, the aperture is always situated in that part of the stomach which lies to the left of the cardia, is very large, of an irregular form, and ragged and pulpy at the edges, which have the appearance of being scraped. The mucous membrane of the stomach is not found inflamed. There is occasionally slight redness, with dark brown or almost black lines (striæ) in and near the dissolved coats, which have an acid reaction. It can only be confounded with perforation by the action of corrosives; but the well marked symptoms during life, and the detection of the poison after death, together with the changes in the fauces and œsophagus, will at once indicate the perforation produced by corrosive poison. A case of extensive perforation of the stomach, as the result of the action of the gastric fluids, has been recently reported by Dr. Barnes. (See Med. Gazette, vol. xli. p. 293.)

CHAPTER IV.

RULES TO BE OBSERVED IN INVESTIGATING A CASE OF POISONING—WITH RESPECT TO THE PATIENT WHILE LIVING—THE INSPECTION OF THE BODY—THE EXHUMATION OF BODIES—DISPOSAL OF THE VISCERA. IDENTITY OF SUBSTANCES. PRESERVATION OF ARTICLES FOR ANALYSIS. ON THE USE OF NOTES—WHEN ALLOWED TO BE USED IN EVIDENCE——MEDICO-LEGAL REPORTS.

WHEN a practitioner is called to a case of poisoning, it is above all things necessary that he should know to what points he ought to give his attention. It is very proper that every effort should be made by him to save life when the individual is living: but while engaged in one duty, it is also in his power to perform another, supposing the case to be one of suspected criminal poisoning,—namely, to note down many circumstances which may tend to detect the perpetrator of the crime. There is no person so well fitted to observe these points as a medical man; but it unfortunately happens, that many facts important as evidence, are often overlooked. The necessity for observing and recording them is not perhaps generally known. A medical man need not make himself officious on such occasions, but he would be sadly unmindful of his duty as a member of

society, if he did not aid the course of justice by extending his scientific knowledge to the detection of crime. It is much to the credit of the medical profession, that the crime of murder by poisoning—a form of death from which no caution or foresight can protect an individual, is so frequently brought to light, by the announcement of suspicious facts of a medical nature to magistrates and coroners; and on several occasions the highest compliments have been passed by judges on medical practitioners who have been thus indirectly the means of bringing an atrocious criminal to the bar of justice.

The following appear to me to be the principal points which demand the attention of a medical jurist in all cases of suspected poisoning:—1. With respect to

Symptoms.

1. The time of their occurrence,—their nature. 2. The exact period at which they were observed to take place after a meal, or after food or medicine had been taken. 3. The order of their occurrence. 4. Whether there was any remission or intermission in their progress, or whether they continued to become more and more aggravated until death. 5. Whether the patient had laboured under any previous illness. 6. Whether the symptoms were observed to recur more violently after a particular meal, or after any particular kind of food or medicine. 7. Whether the patient has vomited:—the vomited matters, if any, (especially those *first* ejected,) to be procured:—their odour, colour, acid or alkaline reaction noted,—as well as their quantity. 8. If none be procurable, and the vomiting have taken place on the dress, furniture, or floor of a room,—then a portion of the clothing, sheet, or carpet, may be cut out and reserved for analysis;—if the vomiting have occurred on a deal floor, a portion of the wood may be scraped or cut out;—or if on a stone pavement, then a clean piece of rag or sponge soaked in distilled water, may be used to remove any traces of the substance. [Some years since, an animal was poisoned by arsenic. None of the poison could be detected in the stomach, but it was easily found in a portion of deal floor, rendered humid by the liquid matters which the animal had vomited during the night.] The vessel in which vomited matters have been contained will often furnish valuable evidence, since heavy mineral poisons fall to the bottom, or adhere to the sides of the vessel. [Whether the patient experienced any sensation of acridity or burning in the throat or mouth, previous to the occurrence of vomiting. Dr. Griffith notes this inquiry as especially important, where the poison is supposed to be one of the irritants.—H.] 9. Endeavour to ascertain the probable nature of the food or medicine last taken, and the exact *time* at which it was taken. 10. Ascertain the nature of *all* the different articles of food used at a meal. 11. Any suspected articles of food, as well as the vomited matter, to be as soon as possible sealed up in a clean glass vessel, labelled, and reserved for analysis. 12. Note down, in their own words, all explanations voluntarily made by parties present, or who are supposed to be concerned in the suspected poisoning. 13. Whether more than one person partook of the food or medicine:—if so, whether all these persons were affected, and how? 14. Whether the same kind of food or medicine had been taken before by the patient or other persons without ill effects following. In the event of the *death* of the patient, it will be necessary for the practitioner to note down—15. The *exact time* of death, and thus determine how long a period the person has survived after having been first attacked with the suspicious symptoms. 16. Observe the attitude and position of the body. 17. Observe the state of the dress. 18. Observe all surrounding objects. Any bottles, paper-packets, weapons, or spilled liquids lying about, should be collected and preserved. 19. Collect any vomited matters near the deceased. Observe whether vomiting has taken place in the recumbent position or not. If the person has vomited in the erect or sitting posture, the front of the dress will commonly be found covered with the vomited matters.

Inspection of the Body.

20. Note the external appearances of the body, whether the surface be livid or pallid. 21. Note the state of the countenance. 22. Note all marks of violence on the person or discomposure of the dress,—marks of blood, &c. 23. Observe the presence or absence of warmth or coldness in the legs, arms, abdomen, mouth, or axillæ. 24. The presence of rigidity or cadaverous spasm in the body. To give any value to the two last-mentioned characters, it is necessary for the practitioner to observe the nature of the floor on which the body is lying, whether this be clothed or naked, young or old, fat or emaciated. All these conditions create a difference in respect to the cooling of the body and the access of rigidity. 25. If found dead—When was the deceased last seen living, or known to have been alive? 26. Note all circumstances leading to a suspicion of suicide or murder. 27. The time after death at which the inspection is made. 28. Observe the state of the abdominal viscera. If the stomach and intestines be found inflamed, the seat of inflammation should be exactly specified; also all marks of softening, ulceration, effusion of blood, corrosion, or perforation. The stomach should be removed and placed in a separate vessel, a ligature being applied at the cardiac and pyloric ends. 29. The contents of the stomach should be collected in a clean *graduated* vessel:—notice *a* the quantity, *b* the odour tried by several persons, *c* the colour, *d* acid or alkaline reaction; *e* presence of blood, mucus or bile; *f* presence of undigested food: and here it may be as well to observe, that the presence of farinaceous matters (bread) would be indicated by the addition of iodine water, if the contents were not alkaline—of fat, by heat; *g* other special characters. 30. The contents of the duodenum should be separately collected, ligatures being applied to it. 31. Observe the state of the large intestines, especially the rectum, and note the condition of their contents. The discovery of hardened fæces in the rectum would prove that purging had not existed recently before death. In one case which I had lately to examine, this became a question of considerable importance. 32. The state of the larynx, fauces, and œsophagus,—whether there be in these parts any foreign substances, or marks of inflammation or corrosion. This is of essential importance, as it throws light upon the question, whether the poison swallowed was irritant or corrosive, and whether it had or had not a local chemical action. 33. The state of the thoracic viscera:—all morbid changes noted. 34. The state of the brain. 35. The condition of the genital organs should be examined, as, in the female, poison has been sometimes introduced into the system by the vagina.

Such are the points to which, in the greater number of cases of suspected poisoning, a medical jurist should attend. By means of these data, noted according to the particular case to which they are adapted, he will in general be enabled, without difficulty, to determine the probable time of death, and the actual means by which death was brought about. He may thereby have it in his power also to point out the dish or article of food which had contained the poison, if the case be one of poisoning; and to throw light upon any disputed question of suicide or murder in relation to the deceased. Many cases of poisoning are rendered obscure, owing to these points not having been attended to in the first instance.

I have not considered it necessary to enter into any details respecting the mode of performing an *inspection*. This the practitioner will have acquired during his study of anatomy: and the only essential points, in addition to those mentioned, are—1. To examine all the important organs for marks of natural disease; and 2. To note down any unusual pathological appearances, or abnormal deviations; although they may at the time appear to have no bearing on the question of poisoning. It is useful to bear in mind on these occasions, that the body is inspected, not merely to show that the individual has died from poison, but to prove that he has *not* died from any *natural cause* of disease. Medical practi-

tioners commonly give their attention exclusively to the first point; while lawyers, who defend accused parties, very properly direct a most searching examination to the last mentioned point, *i. e.* the healthy or unhealthy state of those organs which are essential to life, and with which the poison has not probably come in contact. The most usual causes of *sudden death* commonly have their seat in the brain, the heart and its great vessels, and in the lungs. Marks of effusion of blood, congestion, inflammation, suppuration, or a diseased condition of the valves of the heart, should be sought for and accurately noted, whatever may be the condition of the abdominal viscera. It has also been recommended that an examination of the spinal marrow should be made. If the cause of death be very obscure after the general examination of the body, there may be some reason for inspecting the condition of this organ.

Exhumation of bodies.—Sometimes the inspection of a body is required to be made long after interment. So long as the coffin remains entire, there may be the expectation of discovering certain kinds of mineral poison in the organs; but decomposition may have advanced so far as to destroy all pathological evidence. The inspection is in such cases commonly confined to the abdominal viscera. The stomach is often found so thinned and collapsed, that the anterior and posterior walls appear to form only one coat. This organ should be removed, with the duodenum, and ligatures applied to each. The liver and the spleen should also be removed, in order that they may, if necessary, be separately analyzed. If poison be not found in one or more of these viscera, it is not likely that it will be discovered in the body. It has been recommended that a portion of earth immediately above and below the coffin should be removed for analysis, as it may contain arsenic: but this appears to me to be an unnecessary piece of refinement, in those cases where the coffin is entire, or where the abdominal parietes still cover the viscera. When decomposition has so far advanced as to have led to a mixture of the earth with the viscera, and the poison is found in very minute quantity in the tissues only, the case may be regarded as doubtful. In giving a positive opinion upon such hyperchemical views, it might be fairly objected that traces of arsenic always exist in the iron and brass nails and ornaments which are used in a coffin; and this arsenic is just as likely to furnish a valid objection to medico-legal researches as that which is said to be a constituent of all soils in which oxide of iron abounds! The body of a deceased person, when exhumed, should be identified by some friend or relative, in the presence of the medical examiner. In one case of murder by poison the evidence almost failed, owing to this precaution not having been taken.

It is important that the viscera taken from a body which has been long in the grave should be sealed up immediately. They should not be allowed to come in contact with any metal, nor with any surface except that of clean glass, porcelain, or wood. It has been recommended that they should be washed with chloride of lime, or placed in alcohol; but this is decidedly improper: the use of any preservative chemical liquid would not only embarrass the future analysis, but would render a special examination of an unused portion of the liquid necessary—the identity of which would have to be unequivocally established. Preservation from air in clean glass vessels, with well fitted corks, covered with skin, or, what is still better, sheet-caoutchouc, is all that is required in practice.

Identity of Substances.

It is necessary to observe, that all legal authorities rigorously insist upon proof being adduced of the *identity* of the vomited matters or other liquids taken from the body of a deceased person, when poisoning is suspected. Supposing that during the post-mortem examination the stomach and viscera are removed from the body, they should never be placed on any surface, or in any vessel, until we have first ascertained that the surface or vessel is perfectly *clean*. If this point be not attended to, it will be in the power of counsel to raise a doubt in the

minds of the jury, whether the poisonous substance might not have been accidentally present in the vessel used. This may be regarded as a very remote presumption; but, nevertheless, it is upon technical objections of this kind, that acquittals follow, in spite of the strongest presumptions of guilt. This is a question for which every medical witness should be prepared, whether he be giving his evidence at a coroner's inquest, or in a court of law. Many might feel disposed to regard matters of this kind as involving unnecessary nicety and care; but if they be neglected, it is possible that a case may be at once stopped: so that any care subsequently bestowed upon the chemical analysis by the practitioner will have been thrown away. Evidence of the presence of poison in the contents of a stomach was once rejected at a trial for murder, because they had been hastily thrown into a jar borrowed from a neighbouring grocer's shop; and it could not be satisfactorily proved that the jar was clean and entirely free from traces of poison (in which the grocer dealt) when used for this purpose. When the life of a human being is at stake, as in a charge of murder by poisoning, the slightest doubt is always very properly interpreted in favour of the accused.

Not only must clean vessels be used for receiving any liquid destined for subsequent chemical analysis, but care must be taken by the practitioner that the *identity* of a substance is preserved, or the most correct analysis afterwards made, will be inadmissible as evidence. The suspected substance, when once placed in his hands, should never be let out of his sight or custody. It should be kept sealed under his private seal, and locked up, while in his possession, in a closet to which no other person has a key. If he has once let it out of his hands, and allowed it to pass through the hands of several other persons, then he complicates the evidence for the prosecution, by rendering it indispensable for these parties to state under what circumstances it was placed while in their possession. The exposure of a suspected substance on a table, or in a closet or room, to which many have access, may be fatal to its identity; for the chemical evidence, so important in a criminal investigation, will probably be altogether rejected by the court. A few years ago, a case was tried on the Norfolk circuit, in which the analysis of the matters vomited by a person poisoned by arsenic, was not admitted as evidence against the prisoner, because the practitioner had left them in the keeping of two ignorant women; and these women had allowed the vessel containing the suspected liquid (which was proved to contain arsenic) to be exposed in a room open to the access of many persons. In another case, tried at the Old Bailey Sessions in 1835, the analysis of some suspected liquids was not allowed in evidence, because the practitioner, who lived in the country, and was unwilling to take upon himself the responsibility of analyzing them, had sent them up to town by a carrier, to be examined by a London chemist. If closely sealed by a private seal, and this be observed by the receiver to be unbroken, before he proceeds to the analysis—this mode of transmission will not probably be objected to. When any article (*e. g.* a stomach or other viscus) is reserved for analysis, care should be taken to attach immediately to it, or the vessel containing it, a parchment or wooden label upon which is plainly written in ink, the name of the deceased and the date of removal, including the day of the week and month. This is especially necessary when there are two or more articles for analysis. I have known the greatest inconvenience to result from the neglect of this simple precaution.

Preserving articles for analysis.—In removing viscera or liquids from the body, and reserving them for analysis, it is necessary to observe certain precautions. A clean vessel with a wide mouth should be selected: it should be only sufficiently large to hold the viscus or liquid (the less air remaining in it the better;) it should be secured by a closely fitting cork, covered with fine skin or bladder. Another piece of skin should then be tied over the mouth, or for this sheet-caoutchouc may be substituted with advantage. It should then be covered with tin-foil, and lastly with white leather. In this way any loss by evaporation

or decomposition is prevented, and the viscera may be preserved (in a cool place) for some time. If the mouth of the vessel be too wide for a cork, the other articles cannot be dispensed with. Paper only should not be used: I have known the post-mortem appearances of the viscera of an infant, suspected to have died from poison, entirely destroyed by drying, from the evaporation which took place through the layers of paper with which the vessel in which they were contained was covered. The practitioner should bear in mind that all these matters are likely to come out in evidence; and whatever is worth doing at all, is worth doing well. For reasons already stated no antiseptic should be used. The addition of alum or alcohol to the viscera may seriously embarrass the analysis.

On the use of Notes.—It has already been recommended as a rule in these criminal investigations, that a practitioner should make notes of what he observes in regard to symptoms, post-mortem appearances, and the results of a chemical analysis. From the common forms of law in this country, an individual charged with the crime of poisoning may remain imprisoned, if at a distance from the metropolis, for some months before he is brought to trial. It is obvious, however clear the circumstances may at the time appear to the practitioner, that it will require more than ordinary powers of memory to retain, for so long a period, a distinct recollection of all the facts of the case. If he be unprovided with notes, and his memory be defective, then the case will turn in favour of the prisoner, for he will be the party to benefit by the neglect of the witness. In adopting the plan here recommended, such a result may be easily prevented. It may be remarked, that the law relative to the admissibility of notes or memoranda in evidence is very strict, and is rigorously insisted on by the judges. In order to render such notes or memoranda admissible, it is indispensably necessary that they should be taken on the spot at the time the observations are made, or as soon afterwards as practicable.

Medico-legal Reports.—One of the duties of the medical jurist is to draw up a report of the results of his examination: 1, in regard to symptoms: 2, in regard to the post-mortem appearances; and, 3, in regard to the results of an analysis. With respect to the first two divisions of the report, I must refer the reader to the rules for investigating cases of poisoning. I need hardly observe that the time at which the person was first seen, and the circumstances under which the attendance of the practitioner was required, as well as the period of death, should be particularly stated. The hour, the day of the week, and the day of the month, should be invariably mentioned. Some medical witnesses merely state the day of the week, without that of the month, or vice versa. At a trial this creates great confusion, by rendering a reference to almanacs necessary. The words yesterday, next day, &c. should never be used. The facts which it will be necessary to enter in the report are specially stated under the heads of investigation (see p. 53.) If these facts be not observed in the order there set down, their value as evidence of the cause of death, or of the criminality of particular parties, will be entirely lost. In drawing up a report of symptoms and post-mortem appearances, the facts should be in the first instance plainly and concisely stated *seriatim*, in language easily intelligible to non-professional persons. A reporter is not called upon to display his erudition, but to make himself understood. If technical terms are employed, their meaning should be stated in parentheses. When a subject is thoroughly understood, there can be no difficulty in rendering it in simple language; and when it is not well understood the practitioner is not in a position to make a report. Magistrates, coroners, and barristers, are very acute, and easily detect ignorance, even when it appears under the mask of erudition.

In recording facts, a reporter should not encumber his statements with opinions and inferences. His conclusions should be reserved until the end of the report. The language in which conclusions are expressed should be precise and clear. It must be remembered that these are to form a concise summary of the whole

report, upon which the judgment of a magistrate or the decision of a coroner's jury will be ultimately based. They should be most strictly kept to the matters which are the subject of inquiry. Thus, they commonly refer to the following questions. What was the cause of death? What are the medical circumstances which lead you to suppose that death was caused by poison? What are the circumstances which lead you to suppose that death was *not* caused by natural disease? Answers to one or all of these questions comprise, in general, all that the reporter is required to introduce into the conclusions of his report.

The reporter must remember, that his conclusions are to be based only upon *medical* facts,—not upon moral circumstances, unless he be especially required to express his opinion with regard to them, when they are of a medico-moral nature. Further, they must be based only on what *he has himself seen or observed.* Any information derived from others should not be made the basis of an opinion in a medico-legal report. It is scarcely necessary to remark, that a conclusion based upon mere *probabilities* is of no value as evidence.

In drawing up a report on the *results of a chemical analysis,* the following rules may be borne in mind. A liquid or solid is reserved for analysis. 1. When, and of whom, or how received? 2. In what state was it received—secured in any way, or exposed? 3. If more than one substance received, each to be separately and distinctly labelled; appearance of the vessel, its capacity, and the quantity of liquid (by measure) or solid (by weight) contained therein. 4. Where and when did you proceed to make the analysis, and where was the substance kept during the intermediate period? 5. Did any one assist you, or did you make the analysis yourself? 6. Physical characters of the substance. 7. Processes and tests employed for determining whether it contained poison. All the steps of these processes need not be described;—a general outline of the analysis will suffice. The magistrate may thus satisfy himself by an appeal to others (if necessary) to say whether the analysis has or has not been properly made. 8. Supposing the substance to contain poison,—is this in a pure state, or mixed with any other body? 9. The strength of the poison, if an acid, or if it be in solution: in *all* cases, the *quantity* of poison present. 10. Supposing no poison to be contained in it, what was the nature of the substance? Did it contain any thing likely to injure health or destroy life? 11. Could the supposed poisonous substances exist naturally or be produced within the body? 12. What quantity of the poison discovered would suffice to destroy life, and how far is the dose likely to be modified by age or disease?

There are few reports in which answers to most of these questions, although not formally put, will not be required: and unless the whole of them be borne in mind by the operator at the time an analysis is undertaken, those which are omitted can never receive an answer, however important to the ends of justice that answer may ultimately become.

The results of analysis in the shape of sublimates or precipitates should be preserved as evidence, distinctly labelled to correspond with the report, in small glass tubes hermetically sealed. In this way they may be produced for examination at the inquest or trial.

IRRITANT POISONS.

CHAPTER V.

DIVISION OF IRRITANT POISONS. SULPHURIC ACID, OR OIL OF VITRIOL. SYMPTOMS CAUSED BY THIS POISON IN THE CONCENTRATED AND DILUTED STATE—POST-MORTEM APPEARANCES. QUANTITY OF ACID REQUIRED TO DESTROY LIFE—FATAL DOSES—PERIOD AT WHICH DEATH TAKES PLACE—TREATMENT—CHEMICAL ANALYSIS—MODE OF DETECTING THE POISON IN PURE AND MIXED LIQUIDS—ITS DETECTION IN ARTICLES OF CLOTHING—POISONING BY SULPHATE OF INDIGO.

General Remarks.—IRRITANT POISONS may be divided into four groups—the non-metallic—the metalloids—the metallic—and those of an organic nature, *i. e.* derived from the vegetable and animal kingdoms. The non-metallic irritants comprise the mineral acids, oxalic acid, the alkalies, and their salts. According to strict chemical views, the alkalies and their salts should be placed among the metallic irritants; but it will be, in many respects, convenient to consider them in the same group with the acids. Besides, although they certainly have metallic bases, the demonstration of the existence of the metal is never required at the hands of a medical jurist, as in the case of the true metallic irritants. Among the mineral acids, we shall first speak of poisoning by sulphuric acid.

SULPHURIC ACID, OR OIL OF VITRIOL.

Symptoms.—When this poison is swallowed in a concentrated form, the symptoms produced come on *immediately* or during the act of swallowing. There is violent burning pain, extending through the fauces and œsophagus to the stomach—the pain is often so severe that the body is bent. There is an escape of gaseous and frothy matter, followed by retching and vomiting, the latter accompanied by the discharge of shreds of tough mucus and of a liquid of a dark coffee-ground colour, mixed with blood. The mouth is excoriated, the lining membrane and surface of the tongue white, or resembling soaked parchment—in one instance the appearance of the mouth was as if it had been smeared with white paint: after a time, the membrane acquires a gray or brownish colour; the cavity is filled with a thick viscid substance consisting of saliva, mucus, and the membrane of the mouth:—this renders speaking and swallowing very difficult. If the poison has been administered by a spoon, or the phial containing it has been passed to the back of the fauces, the mouth may escape the chemical action of the acid. A medical witness must bear this circumstance in mind, when he is called to examine an infant suspected to have been poisoned by sulphuric acid. Around the lips and on the neck may be found spots of a brown colour from the action of the acid on the skin. There is extreme difficulty of breathing, owing to the swelling and excoriation of the fauces and larynx, and the countenance has from this cause a blueish or livid appearance;—the least motion of the abdominal muscles is attended with increase of pain. These symptoms have been

sometimes mistaken for those of disease. (Henke, Zeitschrift der S. A. 1843, ii. 284.) The stomach is so irritable that whatever is swallowed is immediately ejected, and the vomiting is commonly violent and incessant. In an interesting case communicated to the Medical Gazette by my friend, Dr. Geoghegan, of Dublin, the patient vomited for three or four hours. This symptom then ceased, and did not recur, although she did not die until thirty-four hours after the poison had been swallowed. (Med. Gaz., vol. xlviii. p. 328.) The matters *first* vomited generally contain the poison: they are acid, and if they fall on a limestone pavement there is effervescence, if on coloured articles of dress, the colour is sometimes altered to a red or yellow (if logwood,) or the colour is discharged and the texture of the stuff destroyed:—on a black cloth dress, the spots produced by the concentrated acid are brown, and remain moist for a considerable time. An attention to these circumstances may often lead to a suspicion of the real cause of the symptoms, when the facts are concealed. After a time there is great exhaustion, accompanied by general weakness:—the pulse becomes quick, small, and feeble; the skin cold, mottled, and covered with a clammy sweat. There is generally great thirst, with obstinate constipation of the bowels:—should any evacuations take place, they are commonly either of a dark brown or leaden colour,—in some instances almost black, arising from the admixture of altered blood. There are sometimes convulsive motions of the muscles, especially of those of the face and lips. The countenance, if not livid from obstructed respiration, is pale, expressive of great anxiety, and of the most dreadful suffering. The intellectual faculties are quite clear, and death usually takes place very suddenly, in from eighteen to twenty-four hours after the poison has been taken.

Post-mortem appearances.—It has been remarked that these are not always to be found in the stomach; they may be confined to the region of the fauces and larynx. In an inspection of the body, the whole course of the alimentary canal, from the mouth downwards, ought to be examined; since in recent or acute cases, it is in the œsophagus and fauces that we generally obtain strong evidence of the action of a corrosive poison. The discovery of the usual marks of corrosion in these parts is always highly corroborative of the signs of poisoning found in the stomach. During the inspection, the examiner must not omit to notice any spots on the skin produced by the action of the acid:—these are commonly of a dark brown colour, and are situated about the mouth, lips, and neck. The appearances met with in the body will vary, according to whether death has taken place rapidly or slowly. Supposing the case to have proved fatal very rapidly, the membrane lining the *mouth* will be found white, softened, and corroded; but this appearance may be absent. The mucous membrane of the *fauces* and *œsophagus* will commonly be found corroded, having sometimes a brownish or ash-gray colour. The corroded membrane of the œsophagus is occasionally disposed in longitudinal folds, portions of it being partly detached. The *stomach*, if not perforated, is collapsed and contracted. On laying it open, the contents are commonly found of a dark brown or black colour, and of a tarry consistency, being formed in great part of mucus and altered blood. The contents may or may not be acid, according to the time the patient has survived, and the treatment which has been adopted. On removing them, the stomach may be seen traversed by black lines, or the whole of the mucous membrane may be corrugated, and stained of a dark brown or black colour. This blackness is not removed by washing. On stretching the stomach, traces of inflammation may be found between the folds, indicated by a deep crimson-red colour. On removing the blackened membrane, the red colour indicative of inflammation may be also seen in the parts beneath. Both the dark colour and marks of inflammation are sometimes partial, being confined to insulated portions of the mucous membrane. When the stomach is perforated, the coats are softened, and the edge of the aperture is commonly black and irregular. In removing the stomach, the aperture is apt to be made larger by the mere weight of the organ. The contents do

not always escape; but when this happens, the surrounding viscera are attacked by the poison. [According to Dr. Griffiths, perforation of the stomach has been found to take place in about one-third of the cases of death from this poison. H.] In a case which occurred at Guy's Hospital, the spleen, the liver, and the coats of the aorta, were found blackened and corroded by the acid, which had escaped through the perforation. When the person has survived for eighteen or twenty hours, traces of corrosive and inflammatory action may be found in the small intestines. In one case the mucous membrane of the ileum was corroded. The interior of the larynx, as well as of the bronchial tubes, has also presented marks of the local action of the acid. The acid has thus destroyed life without reaching the stomach. A remarkable instance in which the poison penetrated into and destroyed both lungs has been reported by Dr. Gull. (See Med. Gaz. vol. xlv. p. 1102.)

It is important for the medical witness to bear in mind that the condition of the fauces and œsophagus above described, is not constantly met with. Strange as it may appear, cases are recorded in which, notwithstanding the introduction of the poison into the stomach, the œsophagus has escaped its chemical action.

When the acid has been taken in a *diluted* state, the marks of inflammation on the mucous membrane are more decided, and the charring is not so considerable. Nevertheless, the acid, unless too much diluted, acts upon and darkens the blood in the vessels, as well as that contained in the stomach, although it may not blacken the mucous membrane or the contents.

Quantity required to destroy life.—The dangerous effects of this poison appear to arise rather from its degree of concentration, than from the absolute quantity taken. The quantity actually required to prove fatal must depend on many circumstances. If the stomach be full when it is swallowed, the action of the acid may be spent on the food and not on the stomach; and a larger quantity might thus be taken, than would suffice to destroy life if the organ were empty. The smallest quantity which is described as having proved fatal was in the following case. Half a tea-spoonful of concentrated sulphuric acid was given to a child about a year old by mistake for castor-oil. The usual symptoms came on, with great disturbance of the respiratory functions; and the child died in twenty-four hours. The quantity here taken could not have exceeded *forty drops*. (Med. Gaz. vol. xxix. p. 147.) It is, however, doubtful whether this small quantity would have proved fatal to an adult. The smallest fatal dose which Dr. Christison states he has found recorded was *one drachm;* it was taken, by mistake, by a stout young man, and killed him in seven days. (Op. cit. 162.)

Period at which death takes place.—It has been already stated that the average period at which death takes place in cases of acute poisoning by sulphuric acid, is from eighteen to twenty-four hours. When the stomach is perforated by the acid, it commonly proves more speedily fatal. In one instance, reported by Dr. Sinclair, a child about four years old died in four hours—the stomach was perforated. When the poison acts upon the larynx, death may be a still more speedy consequence from suffocation; and, owing to this, it appears to be more rapidly fatal to children than adults. Dr. Craigie mentions a case in which three ounces of concentrated sulphuric acid destroyed life in three hours and a half; but the shortest case on record is, perhaps, that mentioned by Remer in Hufeland's Journal. In this instance death took place *in two hours*. A case is reported by Mr. Watson, in which a woman swallowed two ounces of the strong acid. She died in *half an hour*, but it appears that a quarter of an hour before death she had made a deep wound in her throat, which gave rise to great hemorrhage. The stomach was found very extensively perforated:—but it is highly probable that the wound accelerated death in this case.

On the other hand, there are numerous instances reported, in which the poison proved fatal, from secondary causes, at periods varying from one week to several months.

Chemical analysis.—This acid may be met with either concentrated or diluted; and a medical jurist may have to examine it under three conditions: 1. In its simple state. 2. When mixed with organic matters, as with liquid articles of food, or in the contents of the stomach. 3. On solid organic substances, as where the acid has been thrown or spilled on articles of dress or clothing.

In the simple state.—If *concentrated*, it possesses these properties: 1. A piece of wood or other organic matter plunged into it, is immediately carbonized or charred. 2. When boiled with wood, copper-cuttings, or mercury, it evolves fumes of sulphurous acid; this is immediately known by the odour, as well as by the acid vapour first rendering blue, and then bleaching starch-paper dipped in a solution of iodic acid. 3. When mixed with an equal bulk of water, great heat is evolved (nearly 200° F. in a cold vessel.)

The diluted acid. For the acid in a *diluted* state, but one test need be applied:—a solution of a salt of barytes,—the *Nitrate of barytes*, or the *Chloride of barium*. Having ascertained, by test-paper, that the liquid is acid, we add to a portion of it a few drops of nitric acid, and then a solution of nitrate of barytes. If sulphuric acid be present, a dense white precipitate of sulphate of barytes will fall down—which is insoluble in all acids and alkalies. If this precipitate be collected, dried and heated to redness in a small platina crucible with five or six parts of charcoal powder, it will, if a sulphate, be converted to sulphuret of barium. To prove this, we add to the calcined residue diluted muriatic acid, at the same time suspending over it a slip of filtering paper moistened with a solution of acetate of lead, or, what is exceedingly convenient, we place the residue on a slip of glazed card, (coated with carbonate of lead,) scraped and wetted on the surface. (The card should be first tested for lead; because some kinds of glazed cards are made without lead.) If the original precipitate was a sulphate, the gas now evolved will be sulphuretted hydrogen, known by its odour, and by its turning the salt of lead or staining the card of a brown colour. Instead of charcoal, we may use an equal bulk of cyanide of potassium as the reducing agent, and the experiment may then be performed in a small reduction tube over a spirit lamp. On breaking the tube and placing the powder on a glazed card (containing lead) previously wetted, the stain of sulphuret of lead will be perceived;—or the calcined residue may be dissolved in water and tested. The smallest visible quantity of sulphate of barytes thus admits of easy detection.

In liquids containing organic matter.—If the sulphuric acid be mixed with such liquids as porter, coffee, or tea, the process for its detection is substantially the same, the liquid being rendered clear by filtration previously to adding the test. The sulphate of barytes, if mixed with organic matter, may be purified by boiling it in strong nitric acid; but this is not commonly necessary, as the reduction of the precipitate may be equally well performed with the impure, as with the pure sulphate. Some liquids generally contain sulphuric acid or a sulphate, such as vinegar and porter, but the acid is in very minute proportion; therefore, if there be an abundant precipitate, there can be no doubt, *cæteris paribus*, that free sulphuric acid has been added to them. Should the liquid be thick and viscid like gruel, it may be diluted with water, and then boiled with the addition of a little acetic acid. For the action of the test, it is not necessary that the liquid should be absolutely clear, provided it be not so thick as to interfere mechanically with the precipitation of the sulphate of barytes. So far with regard to articles administered, or of which the administration has been attempted. The same rules apply to the examination of matters *vomited* and of the *contents of the stomach*,—care being taken to separate the insoluble parts by filtration, before adding the test.

On solid organic substances.—It sometimes happens in cases of poisoning that sulphuric acid is spilled upon articles of clothing, such as cloth or linen, and here a medical jurist may succeed in detecting it, when every other source of chemi-

cal evidence fails. Again, sulphuric acid is often used for the purpose of seriously injuring a party, as by throwing it on the person,—an offence which, when accompanied with bodily injury, renders the offender liable to a severe punishment. On such occasions, proof of the nature of the corrosive liquid is required; and this is easily obtained by a chemical examination of a part of the dress. The process of analysis is very simple. The piece of cloth should be digested in a small quantity of distilled water at a gentle heat, whereby a brownish-coloured liquid is commonly obtained on filtration. If sulphuric acid be present, the liquid will have a strong acid reaction, and produce the usual effects with the barytic test.

Sulphate of Indigo.

Several cases of accidental poisoning by this substance have occurred. As the compound is nothing more than a solution of indigo in common sulphuric acid, the symptoms and post-mortem appearances are the same as those which have been described for the latter substance. This kind of poisoning may be suspected, when, with these symptoms, the membrane of the mouth has a blue colour. The vomited matters, as well as the fæces, are at first of a deep blue tint; afterwards green; and it was observed in two instances that the urine had a blue tinge.

It is proper to notice, that as indigo is one of the substances now directed by the statute to be mixed with arsenic when sold in small quantities, the detection of this colouring principle in the mouth and vomited matters will not necessarily show that it has been taken in the form of sulphate.

CHAPTER VI.

POISONING BY NITRIC ACID OR AQUA FORTIS. ACTION OF THE CONCENTRATED AND DILUTED ACIDS—POST-MORTEM APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—PERIOD AT WHICH DEATH TAKES PLACE. PROCESSES FOR DETECTING THE POISON IN PURE AND ORGANIC LIQUIDS. POISONING BY MURIATIC ACID.

General Remarks.—Nitric acid is popularly known under the name of Aqua fortis, or Red spirit of nitre. According to Tartra, it seems to have been first used as a poison about the middle of the fifteenth century. Although it is perhaps much more used in the arts than oil of vitriol, cases of poisoning by it are by no means common.

Symptoms.—When the acid is in a concentrated state, the symptoms, on the whole, bear a close analogy to those produced by sulphuric acid. They come on *immediately*, and the swallowing of the acid is accompanied by the most intense burning pain in the fauces and œsophagus, extending downwards to the stomach: —there are gaseous eructations, from the chemical action of the poison,—swelling of the abdomen, violent vomiting of liquid or solid matters, mixed with altered blood of a dark brown colour, and shreds of mucus, having a strong acid reaction. The abdomen is generally exquisitely tender: but, in one well marked case of poisoning by this acid, the pain was chiefly confined to the fauces: probably the poison had not reached the stomach. The mucous membrane of the mouth is commonly soft and white, after a time becoming yellow, or even brown; the teeth are also white, and the enamel is partially destroyed by the chemical action of the acid. There is great difficulty of speaking, as well as of deglutition, the mouth being filled with viscid mucus: the power of swallowing is sometimes entirely lost. On opening the mouth, the tongue may be found swollen and of a

citron colour: the tonsils are also swollen and enlarged. The difficulty of respiration is occasionally such as to render tracheotomy indispensable, especially in young subjects. (See case by Mr. Arnott, Med. Gaz. xii. 220.) As the symptoms progress, the pulse becomes small, frequent, and irregular; the surface of the body extremely cold, and there are frequent rigours. The administration of remedies, even the deglutition of the smallest quantity of liquid, increases the severity of the pain, occasions vomiting, and gives rise to a feeling of laceration or burning. Tartra. 144. There is obstinate constipation. Death takes place in from eighteen to twenty-four hours, and is sometimes preceded by a kind of stupor from which the patient is easily roused. The intellectual faculties commonly remain clear until the last. In one instance, the patient was insensible, but she ultimately recovered. Death may be occasioned by this acid in consequence of its action on the larynx, as in the case of sulphuric acid. Should the patient survive the first effects of the poison, the mucous membrane of the fauces and œsophagus may be discharged, either in irregular masses, or in the form of a complete cylinder of the œsophageal lining. There is great irritability of the stomach, with frequent vomiting and ultimate destruction of the powers of digestion: the patient becomes slowly emaciated, and dies from starvation or exhaustion.

Post-mortem appearances. Supposing death to have taken place rapidly, the following appearances will be met with. The skin of the mouth and lips will present various shades of colour from an orange yellow to a brown; it appears like the skin after a blister or burn, and is easily detached from subjacent parts. Yellow spots produced by the spilling of the acid may be found about the hands and neck. A yellow frothy liquid escapes from the nose and mouth, and the abdomen is often much distended. The membrane lining the mouth is sometimes white, at others of a citron colour; the teeth are white, but present a yellowish colour about the coronæ. The pharynx and larynx are much inflamed: the latter sometimes œdematous. The lining membrane of the œsophagus is softened, and of a yellow or brown colour, easily detached, often in long folds. The trachea is more vascular than usual, and the lungs are congested. The most strongly marked changes are, however, seen in the stomach. When not perforated, this organ may be found distended with gas—its mucous membrane partially inflamed with patches of a yellow, brown, or green colour, or it may be even black. This green colour is due to the action of the acid on the colouring matter of the bile; but it must be remembered that a morbid state of the bile itself often gives this appearance to the mucous membrane in many cases of death from natural disease. There is occasionally inflammation of the peritoneum, and the stomach is glued to the surrounding organs. Its coats are often so much *softened*, as to break down under the slightest pressure. In the duodenum similar changes are found; but in some cases the small intestines have presented no other appearance than that of slight vascularity. It might be supposed that the stomach would be in general perforated by this very corrosive substance; but this is far from being the case. Tartra only met with two instances, and in one of these, the individual survived twenty, and in the other thirty hours. In giving this poison to rabbits, I have not found the stomach perforated, although the acid had evidently reached that organ, from its coats being stained of a deep yellow colour. In these experiments the non-perforation appeared to be due to the protective influence of the food with which the stomach was distended. In the very few cases there are reported in English journals, it would appear that the stomach has not been perforated: the poison had been swallowed soon after a meal, and its parietes had thus escaped the corrosive action of the acid.

Quantity required to destroy life.—The *smallest* quantity of this acid which I find reported to have destroyed life, is about *two drachms*. It was in the case of a boy aged thirteen: he died in about thirty-six hours. But less than this, even one drachm, would doubtless suffice to kill a child; and, under certain

circumstances, an adult; for the fatal result depends on the extent of the mischief produced by this corrosive poison in the larynx, œsophagus, and stomach. What is the largest dose of concentrated acid, from the effects of which a person has recovered, it is difficult to say; since, in most of the cases of recovery mentioned by authors, the quantity of the poison taken was unknown.

Period at which death takes place.—Sobernheim relates a case of poisoning by nitric acid, which proved fatal in *one hour and three quarters.* (*Op. cit.* 402.) This I believe to be the *most rapidly* fatal case on record, where the acid acted as a poison. The usual well marked effects were found in the œsophagus, stomach, and duodenum. In young infants, however, life may be destroyed by this poison in a few minutes, should it happen to affect the larynx. The longest case is, perhaps, that recorded by Tartra, where a woman perished from exhaustion, produced by the secondary effects of the poison, *eight months* after having swallowed it.

Treatment.—It should be the same as that recommended in poisoning by sulphuric acid.

Chemical Analysis—In the simple state.—This acid may be met with either concentrated or diluted. The *concentrated acid* varies in colour from a deep orange red to a light straw yellow. It may be recognised: 1. By evolving acid fumes when exposed. 2. By its staining organic matter yellow or brown, the colour being heightened and turned of a reddish tint by contact with caustic alkalies. 3. When mixed with a few copper cuttings, it is rapidly decomposed, a deep red acid vapour is given off, and a greenish-coloured solution of nitrate of copper is formed. Tin or mercury may be substituted for copper in this experiment.

In the diluted state.—This acid is not precipitated like the sulphuric by any common reagent, since all its alkaline combinations are soluble in water.—1. The liquid has a highly acid reaction, and on boiling it with some copper-turnings, red fumes of nitrous acid vapour are given off, unless the proportion of water be very great. At the same time, the liquid acquires a blue colour.—2. A streak made on white paper with the diluted acid, does not carbonize it when heated; but a scarcely visible yellow stain is left.—3. The liquid is neither precipitated by nitrate of barytes nor by nitrate of silver. These last two experiments give merely negative results—they serve to show that the sulphuric and muriatic acids are absent.

In order to detect nitric acid, the liquid should be carefully neutralized by potash, and then evaporated slowly to obtain crystals. If the liquid contain nitric acid, these crystals will possess the following characters:—1. They appear in the form of lengthened fluted prisms, which neither effloresce nor deliquesce on exposure. One drop of the solution evaporated spontaneously on glass will suffice to yield distinct and well formed crystals. This character distinguishes the *nitrate* of potash from a very large number of salts.—2. When moistened with strong sulphuric acid, the powdered crystals slowly evolve a colourless acid vapour. By this test, the nitrate is known from every other deflagrating salt.—3. A portion of the powdered crystals should be placed in a small tube and mixed with their bulk of fine *copper* filings. The mass is then to be moistened with water, and a few drops of strong *sulphuric acid* added. Either with or without the application of a gentle heat, a decomposition immediately ensues, by which red fumes of *nitrous acid* are evolved, recognisable by their colour, odour, and acid reaction.—4. We add to the crystals a small piece of gold-leaf and muriatic acid; then boil for a few minutes. The gold will either wholly or entirely disappear if nitric acid or a nitrate be present. Its partial solution will be indicated by the addition of chloride of tin to the liquid after boiling.

In liquids containing organic matter.—Nitric acid may be administered in such liquids as tea, vinegar, or porter. In this case, besides the acid reaction, there will be the peculiar smell produced by the acid, when mixed with substances

of an organic nature. The application of the usual tests is here counteracted:—thus, unless the quantity of nitric acid in the liquid be very considerable, the orange-red fumes of nitrous acid are not evolved on boiling the liquid with copper-cuttings. If the liquid be viscid, this viscidity must be destroyed by dilution with water:—and in all cases, if any solid or insoluble substances be present, as in the *matters vomited* or *contents of the stomach*, it must be filtered, in order to separate the insoluble portions. This operation is commonly very slow. If we succeed in procuring a clear acid liquid, the colour may be disregarded. We should then carefully neutralize it with a weak solution of carbonate of potash. (Should the liquid thus procured not be acid, we may then boil the organic substance itself with carbonate of potash.) If the liquid be very acid and highly coloured, a portion may be boiled with animal charcoal previously washed with muriatic acid, as some organic colouring matters are partly or wholly removed by this agent. The liquid may then be concentrated to a small bulk by evaporation. As a trial-test we may dip in a slip of bibulous paper, dry it, and observe whether it burns with deflagration. This commonly answers, unless the quantity of nitric acid present be very small, or unless the nitrate of potash formed be mixed with a large portion of some other salt. A few drops of the liquid may be crystallized on a piece of glass by slow evaporation; and the resulting crystals examined for all those properties which have been described as characteristic of the compound of potash with nitric acid. The crystals obtained may be coloured and impure. This circumstance does not at all interfere with the action of the most important test for nitric acid, namely, *that* by copper-filings and sulphuric acid. The crystals, may, however, if necessary, be purified by washing them with ether or alcohol. These liquids do not dissolve the nitrate of potash, but will often serve to remove from it the organic matters by which it is coloured. This process, according to my observation, is, when carefully carried out, effectual in detecting nitric acid in organic liquids. When the nitric acid, or the nitrate to which it has been converted, is mixed with common salt, the copper-test cannot be employed. The gold test will in such a case furnish the best evidence. Muriatic acid may be added to the dried residue, with a small portion of gold-leaf, and the mixture boiled. If nitric acid or a nitrate be present, even in a minute proportion, some portion of the gold will be dissolved—a fact demonstrable by the addition of chloride of tin.

Nitric acid may be detected in *stains on clothing*, if recent, by simply boiling the stained portion in water, with or without the addition of a small quantity of carbonate of potash. The carbonate must be used when an *acid* liquid is not obtained by boiling the stained cloth in distilled water.

Muriatic Acid.

This acid is but seldom taken as a poison. In the few cases which have been hitherto observed, the *symptoms* and appearances have been similar to those caused by nitric acid. I have elsewhere related a recent case of poisoning by this acid (Guy's Hosp. Reports, Oct. 1850, p. 211;) and for another, in which a man recovered after swallowing one ounce, see Lancet, July 27, 1850, p. 113; also for a case of recovery from a similar dose, see Medical Gazette, Dec. 28, 1849. [For another case of recovery from the effects of an ounce, see Boston Med. and Surg. Journ. xv. 270.]

CHAPTER VII.

POISONING BY THE VEGETABLE ACIDS. OXALIC ACID—SYMPTOMS AND EFFECTS—POST-MORTEM APPEARANCES—FATAL DOSES—RECOVERY FROM LARGE DOSES—PERIOD AT WHICH DEATH TAKES PLACE—TREATMENT—CHEMICAL ANALYSIS—TESTS FOR OXALIC ACID IN PURE AND MIXED LIQUIDS—BINOXALATE OF POTASH—TARTARIC ACID—ACETIC ACID—VINEGAR.

Oxalic Acid.

Symptoms.—In many instances of poisoning by oxalic acid, death has taken place so rapidly that the individual has not been seen alive by a medical practitioner. If the poison be taken in a large dose, *i. e.* from half an ounce to an ounce of the crystals, dissolved in water, a hot burning acid taste is experienced in the act of swallowing, with a sense of constriction or suffocation, and vomiting occurs either immediately, or within a few minutes. Should the poison be diluted, there is merely a sensation of strong acidity, and vomiting only occurs after a quarter of an hour or twenty minutes. In some cases there has been little or no vomiting; while in others this symptom has been incessant until death. In a case in which the poison was much diluted, vomiting did not occur for seven hours. (Christison, 221.) The vomited matters are highly acid, and have a greenish brown or almost black colour: they consist chiefly of mucus and altered blood. In one instance, reported by my friend, Dr. Geoghegan, they were colourless. (Med. Gaz. xxxvii. 792.) In another interesting case, reported by Mr. Deane in the Provincial Journal, fluid blood of a bright arterial colour was vomited after some hours. (June 25th, 1851, p. 344.) There is great pain and tenderness in the epigastrium, with a burning sensation in the stomach, followed by cold clammy perspirations, and convulsions. In a case which occurred at Guy's Hospital, in May, 1842, where about two ounces of the poison had been swallowed, there was no pain. Urgent vomiting and collapse were the chief symptoms. There is in general an entire prostration of strength, so that if the individual be in the erect position, he falls: there is likewise unconsciousness of surrounding objects, and a kind of stupor, from which, however, the patient may be without difficulty roused. Owing to the severity of the pain, the legs are sometimes drawn up towards the abdomen. The pulse is small, irregular, and scarcely perceptible; there is a sensation of numbness in the extremities, and the respiration, shortly before death, becomes spasmodic. The inspirations are deep, and a long interval elapses between them. Such are the symptoms commonly observed in a rapidly fatal case.

Should the patient survive the first effects of the poison, the following symptoms appear: there is soreness of the mouth, constriction and burning pain in the throat, with painful deglutition,—tenderness in the abdomen, with irritability of the stomach, so that there is frequent vomiting, accompanied by diarrhœa. The tongue becomes swollen, and there is great thirst. The patient may slowly recover from these symptoms. In a case related by Mr. Edwards to the Westminster Medical Society, the patient, a female, lost her voice for eight days. In former editions of this work, I have treated it as doubtful whether the loss of voice in this case depended on the action of the poison. A case has, however, been reported by Mr. T. W. Bradley, from which it may be inferred that loss of voice may result from the direct effect of oxalic acid on the nervous system. A man swallowed a quarter of an ounce of the acid, and suffered from the usual symptoms in a severe form. In about nine hours, his voice, although naturally deep, had become low and feeble. This weakness of voice remained for more than a month, and its natural strength had not returned even after the lapse of nine weeks. During the first month there was numbness, with tingling of the

legs. (Med. Times, Sept. 14, 1850, p. 292.) The occurrence of this sensation of numbness, and its persistence for so long a period after recovery from the symptoms of irritation, clearly point to a remote effect on the nervous system. Spasmodic twitchings of the muscles of the face and extremities have also been observed in some instances. (See Lancet, March 22, 1851, page 329.)

Post-mortem appearances.—The lining membrane of the mouth, fauces, and œsophagus, is commonly white, although it is often coated with a portion of the brown mucous matter discharged from the stomach. This latter organ contains a dark-brown mucous liquid, often acid, and having almost a gelatinous consistency. On removing the contents, the mucous membrane will be seen pale and softened, without always presenting marks of inflammation or abrasion, if death have taken place rapidly. This membrane is soft and brittle, easily raised by the scalpel, and presents much the appearance which we might suppose it would assume, after having been for some time boiled in water. The small vessels are seen ramifying over the surface, filled with dark-coloured blood, apparently solidified within them. The lining membrane of the œsophagus presents much the same characters. It is pale, and appears as if it had been boiled in water, or digested in alcohol: it has been found strongly raised in longitudinal folds, interrupted by patches where the membrane has become abraded. With respect to the intestines, the upper portion of the canal may be found inflamed; but unless the case be protracted, the appearances in these viscera are not very strongly marked. In a recent case of poisoning by this acid, where two ounces had been taken, and death was rapid, the coats of the stomach presented almost the blackened appearance produced by sulphuric acid, owing to the colour of the altered blood spread over them. It is worthy of remark that the glairy contents of the stomach do not always indicate strong acidity until after they have been boiled in water.

Oxalic acid does not appear to have a strong corrosive action on the stomach, like that possessed by the mineral acids. It is, therefore, rare to hear of the coats of the organ being perforated by it. In many experiments on animals, and in some few observations on the human subject, I have found nothing to bear out the view that perforation is a common effect of the action of this poison. The acid undoubtedly renders the mucous coat soft and brittle, and it dissolves by long contact animal matter, which possesses the properties of gelatine.

In protracted cases, the œsophagus, stomach, and intestines have been found more or less inflamed. In several instances there have been scarcely any perceptible morbid appearances produced. [Death may ensue from oxalic acid, and yet no evidence of its action on the alimentary canal be perceptible on a post-mortem examination: the case of a girl is cited, in the last edition, whose death took place in thirty minutes after she had taken an ounce of the poison. (*London Med. Repos.* iii. 380.)—H.]

Quantity required to destroy life.—A smaller dose than *half an ounce* of the crystallized acid has not, so far as I am aware, been known to prove fatal; although, from the serious effects which have followed doses less than this, it is probable that a smaller quantity might destroy life when medical treatment was not resorted to. Two cases have occurred at Guy's Hospital, where, in each, half an ounce of oxalic acid had been swallowed. Active treatment was adopted, and both patients recovered. When the dose is upwards of half an ounce, death is commonly the result; but one of my pupils informed me of a case where a man recovered, after having taken one ounce of crystallized oxalic acid; and Dr. Brush, of Dublin, has communicated to the Lancet a case in which recovery took place perfectly after a similar dose of the poison had been taken. (See also case by Mr. Allison, in the same journal, Nov. 2, 1850, p. 502.) The acid was in this instance taken by mistake for Epsom salts.

It may be proper to state that this poison is retailed to the public at the rate

of from a quarter to half an ounce for twopence, and one ounce for fourpence or sixpence.

Period at which death takes place.—Equal quantities of this poison do not always destroy life within the same period of time. In two cases, in which about two ounces of the acid were respectively taken, one man died in twenty minutes, —the other in three-quarters of an hour. Dr. Christison mentions an instance, where an ounce killed a girl in thirty minutes; and another where the same quantity destroyed life in *ten minutes*. Dr. Ogilvy, of Coventry, has reported a case of poisoning by oxalic acid, in which it is probable that death took place within *three minutes* after the poison had been swallowed. The sister of the deceased had been absent from the room about that period, and on her return found her dying. The *quantity* of poison taken could not be determined. When the dose of oxalic acid is half an ounce and upwards, death commonly takes place in an hour. There are, it must be admitted, numerous exceptions to this rapidity of action. Dr. Christison reports two cases, which did not prove fatal for thirteen hours; and in an instance that occurred to Mr. Fraser, in which only half an ounce was taken, the individual died from the secondary effects, in a state of perfect exhaustion, twenty-three days after taking the poison.

Chemical analysis. In the simple state.—This acid may be met with either as a solid, or in solution in water. *Solid oxalic acid:* It is seen more or less perfectly crystallized in four-sided prisms, in which respect it differs from all other acids, mineral and vegetable. The crystals are unchangeable in air. They are soluble in water, forming a strongly acid solution.

Tests.—1. *Nitrate of silver.* When added to a solution of oxalic acid, it produces an abundant white precipitate of oxalate of silver. A solution containing so small a quantity of oxalic acid as not to redden litmus paper, is affected by this test; but when the quantity of poison is small, it would be always advisable to concentrate the liquid by evaporation before applying it. The oxalate of silver is identified by the following properties: 1. It is completely dissolved by cold nitric acid. If collected on a filter, thoroughly dried, and heated on thin platina foil, it is entirely dissipated in a white vapour with a slight detonation. When the oxalate is in very small quantity, this detonation may be observed in detached particles on burning the filter previously well dried. 2. *Sulphate of lime.* A solution of oxalic acid is precipitated white by lime water and all the salts of lime. Lime water is itself objectionable as a test, because it is precipitated white by several other acids. The salt of lime, which, as a test, is open to the least objection, is the *sulphate*. As this is not a very soluble salt, its solution must be added in rather large quantity to the suspected poisonous liquid. A fine white precipitate of oxalate of lime is slowly formed. This precipitate should possess the following properties:—1. It ought to be immediately soluble in nitric acid. 2. It ought not to be dissolved by the tartaric, acetic, or any vegetable acid.

In liquids containing organic matter.—The process is the same, whether it be applied to liquids in which the poison is administered, or to the *matters vomited*, or, lastly, to the *contents of the stomach*. This poison readily combines with albumen and gelatine, and it is not liable to be decomposed or precipitated by these or any other organic principles: it is, therefore, commonly found in solution in the liquid portion, which will then have a greater or less acid reaction. Should the liquid be very acid, we must filter it to separate any insoluble matters: should it not be very acid, the whole may be boiled, if necessary, with distilled water, before filtration is performed. On no account are the tests for oxalic acid to be employed in liquids containing organic matter, since nitrate of silver is easily precipitated by such matters, although none of the poison be present. Should the acid liquid be highly coloured, it may be first boiled for some time with well washed animal charcoal. After this it may be filtered and concentrated by evaporation. To the filtered liquid, *acetate of lead* should be added until there is no further precipitation; and the white precipitate formed collected and

washed. If any oxalic acid were present in the liquid, it will exist in this precipitate under the form of oxalate of lead. The following plan may be adopted for separating oxalic acid from the oxalate of lead:—Diffuse the precipitate in water, and pass into the liquid for about two hours, a current of sulphuretted hydrogen gas, taking care that the gas comes in contact with every portion of the precipitate. Black sulphuret of lead will be precipitated; and with it commonly the greater part of the organic matter which may have been mixed with the oxalate of lead. Filter, to separate the sulphuret of lead; the filtered liquid may be clear and highly acid. Concentrate by evaporation; the sulphuretted hydrogen dissolved in the liquid is thereby expelled, and oxalic acid may be ultimately obtained crystallized by evaporation on a piece of plate glass. If there were no oxalic acid present in the precipitate, no crystals will be procured on evaporation. If crystals be obtained, then they must be dissolved in water, and tested in the manner above directed.

Binoxalate of Potash, or Salt of Sorrel.

Symptoms and effects.—The poisonous effects of this salt entirely depend on the oxalic acid which it contains. It is said to be much used for the purpose of bleaching straw and removing ink-stains—being sold under the name of essential salt of lemons. The smallest quantity retailed to the public is a quarter of an ounce, and for this three-half-pence are charged. Its poisonous properties are not commonly known, or no doubt it would be frequently substituted for oxalic acid. Three cases of poisoning by this substance have occurred within a recent period: two of these proved fatal, while in the other the patient recovered.

In the case of recovery, a young lady, aged twenty, swallowed an ounce of the salt dissolved in warm water. She was not seen by any one for an hour and a half: she was then found on the floor, faint and exhausted, having previously vomited considerably. There was great depression, the skin cold and clammy, the pulse feeble, and there was a scalding sensation in the throat and stomach. There were also continued rigors. Proper medical treatment was adopted, and she recovered in two days,—still suffering from debility and great irritation of the stomach. During the state of depression, it was remarked that the conjunctivæ were much injected, and the pupils dilated. There was also great dimness of vision. (Med. Gaz., vol. xxvii. p. 480.)

This salt destroys life almost as readily as oxalic acid itself; and in the symptoms which it produces it closely resembles that poison. In one case, half an ounce killed an adult in so short a time as *eight minutes;* but probably the fatal effects in this instance were accelerated by the debilitated state of the person who took it. In another case reported by M. Chevallier, death took place in ten minutes. (Ann. d'Hyg., 1850, vol. i. p. 162.)

Chemical Analysis.—Its solution might be readily mistaken for oxalic acid: for, 1st, it has an acid reaction; and, 2d, it is precipitated by nitrate of silver and sulphate of lime, like oxalic acid: but with respect to the latter test, the precipitation, although more slowly produced, is much more copious. It is distinguished from oxalic acid—1. By its crystalline form, which, as seen in a few drops evaporated on glass, is plumose; and 2. By heating a portion on platina foil. While oxalic acid is volatile, the binoxalate leaves an ash, which, when sufficiently calcined, is alkaline, and it may be proved to contain potash by its dissolving in dilute nitric acid, with effervescence, and forming nitrate of potash.

Tartaric Acid.

Symptoms and Appearances.—Tartaric acid has been hitherto considered not to possess any poisonous properties; but one case has occurred in which there was no doubt that it acted as an irritant, and destroyed life. The case referred to was the subject of a trial for manslaughter at the Central Criminal Court,

(*Reg.* v. *Watkins*) in January, 1845. The accused gave the deceased, a man aged twenty-four, by mistake, *one ounce* of tartaric acid instead of aperient salts. The deceased swallowed the whole dissolved in half a pint of warm water at a dose: he immediately exclaimed that he was poisoned: he complained of having a burning sensation in his throat and stomach, as though he had drunk oil of vitriol, and that he could compare it to nothing but being all on fire. Soda and magnesia were administered with diluent drinks. Vomiting set in, and continued until death, which took place nine days afterwards. On inspection, nearly the whole of the alimentary canal was found highly inflamed. The accused admitted that he had made a mistake, and tartaric acid was found in the dregs of the cup. The jury acquitted the prisoner. Another case of poisoning by this acid, with a report of the results of analysis, has been recently published by M. Devergie.—(Ann. d'Hyg., 1851, ii. 432.)

Acetic Acid.

This acid has been generally excluded from the class of poisons. Common vinegar, which contains only five per cent. of acetic acid, has often been taken in large doses without injurious consequences. From the experiments performed by Orfila on dogs, and from one case which he reports as having occurred in the human subject, acetic acid, when concentrated, appears to exert an irritant action on the body. (Annales d'Hygiene, 1831, ii. 159; also Toxicologie, ii. 198.) This is not more than we might have expected, seeing that the concentrated acid is highly corrosive. In the case referred to, the deceased, a young female aged nineteen, was found dying on the highway. She suffered from convulsions, and complained of pain in the stomach, and died in a very short time. On inspection, the stomach was found neither softened nor corroded, but its mucous membrane near the pylorus was almost black. The mucous glands were prominent, and the vessels were filled with black coagulated blood.

Vinegar, which may be regarded as an organic mixture containing but a very small proportion of acetic acid, (five per cent.) may be examined by distilling a portion, and testing the distilled liquid for the acid. Vinegar, as it exists in commerce, always contains traces of sulphuric acid. In general it is easily recognised by its odour. Pelletan observed in the case of a young child that the abuse of vinegar led to a thinning of the mucous membranes of the stomach; and Landerer remarked that the milk of a wet-nurse who had been in the habit of taking large quantities of the Vinegar of Roses, became thin, very acid, and deficient in casein and oil. The infant which she was suckling gradually wasted and died, and the woman herself suffered severely. (Heller's Archiv. 1847, 2 H. s. 185.)

CHAPTER VIII.

POISONING BY THE ALKALIES.—POTASH, SODA, AND THEIR CARBONATES—SYMPTOMS—FATAL EFFECTS OF THE CARBONATE OF POTASH—POST-MORTEM APPEARANCES—TREATMENT—AMMONIA AND SESQUICARBONATE OF AMMONIA (SAL VOLATILE)—CHEMICAL ANALYSIS—TESTS FOR POTASH AND SODA—TESTS FOR AMMONIA.

Potash and Soda.

Symptoms.—The symptoms produced by potash and soda, when taken in a strong dose, are so similar that one description will serve for both. It must be observed that cases of alkaline poisoning are extremely rare, and have been, I believe, hitherto the result of accident. The most common form in which these poisons are met with, is in the state of pearlash (carbonate of potash) and soap-

lees (carbonate of soda.) The patient experiences, during the act of swallowing, an acrid caustic taste, owing to the alkaline liquid, if sufficiently concentrated, excoriating the mucous membrane. There is a sensation of burning heat in the throat, extending down the œsophagus to the epigastrium. Vomiting is not always observed; but when it does occur, the vomited matters are sometimes mixed with blood of a dark brown colour, and detached portions of mucous membrane; this effect depending on the degree of causticity in the liquid swallowed. The surface is cold and clammy: there is diarrhœa, with severe pain in the abdomen, resembling colic. The pulse is quick and feeble. In the course of a short time, the lips, tongue, and fauces, become swollen, soft, and red.

Post-Mortem Appearances.—In recent cases there are strong marks of the local action of the poison on the mucous membrane of the mouth, fauces, and œsophagus. This membrane has been found softened, detached, and inflamed in patches of a deep chocolate colour; sometimes almost black. The same appearance has been met with in the mucous membrane of the larynx and trachea. The stomach has had its mucous surface eroded in patches, and there has been partial inflammation.

Period of Death.—The most rapidly fatal case which I have found reported is that of a boy who died in *three hours* after swallowing three ounces of a strong solution of carbonate of potash. In another case, which occurred at Yarmouth, in 1835, a child, aged three years, took a small quantity of pearlash, which had deliquesced, and died in twenty-four hours. Death was caused, in this instance, by the inflammation induced in the larynx causing an obstruction to the process of respiration. In this respect, the caustic alkalies may destroy life like the mineral acids. But death may be a slow result of these poisons. Thus in an instance which was communicated to me, a lady swallowed, by mistake, one ounce and a half of the common solution of potash of the shops, which contains about five per cent. of caustic alkali. She recovered from the first symptoms of irritation, but died seven weeks afterwards, from pure exhaustion, becoming greatly emaciated before her death. Orfila refers to two cases of poisoning by carbonate of potash, in each of which half an ounce of this substance was taken by mistake for aperient salts. The patients, two young men, recovered from the first effects, but ultimately died; the one three months, and the other four months after the poison had been taken. The secondary fatal effects appear to be due to diarrhœa, great irritability of the stomach, loss of the functions of this organ from the destruction of the lining membrane, and stricture of the œsophagus,—either of which causes may prove fatal at almost any period. A fatal case of stricture, produced by soap-lees after the lapse of two years and three months, is reported by Dr. Basham. (Lancet, March 2, 1850.) The constant use of the alkalies or their carbonates appears to be productive of latent mischief; yet the quantity which may be sometimes taken in divided doses without destroying life is enormous. Dr. Tunstall, of Bath, relates the case of a man who, for eighteen years, had been in the habit of taking bicarbonate of soda to remove dyspepsia. It is stated that for sixteen years he took *two ounces* of the bicarbonate daily! The man died suddenly, and on examining the stomach it was found to be greatly distended and extensively diseased,—conditions which were referred by Dr. Tunstall to the action of the carbonate of soda. (Med. Times, Nov. 30, 1850, p. 564.)

Quantity required to destroy life.—The quantity of any of these alkaline poisons, required to destroy life, is unknown.

Chemical analysis.—CAUSTIC POTASH and SODA are known from their respective carbonates by giving a brown precipitate with a solution of nitrate of silver. The CARBONATES, on the other hand, yield a whitish-yellow precipitate. Caustic *potash* is known from caustic *soda* by the following characters:—1. Its solution, when not too much diluted with water, is precipitated of a canary-yellow colour, by bichloride of platina. 2. It is precipitated in granular white crystals,

on adding the alkaline liquid gradually to a strong solution of tartaric acid, and occasionally stirring the mixture, or by digesting in it a large crystal of tartaric acid. Caustic soda is not precipitated by either of these tests, which will serve equally to distinguish the *salts of potash* from those of soda, if we except the binoxalate and bitartrate of potash, which, from being but little soluble in water, are not precipitated. 3. If we neutralize the two alkalies by diluted nitric acid, and crystallize the liquid on a slip of glass, should the alkali be potash, the crystals will have the form of long slender fluted prisms; if soda, of rhombic plates.

In liquids containing organic matter.—Such liquids are frothy; they possess an alkaline reaction, a peculiar alkaline odour, and are unctuous to the feel. The organic liquid may be evaporated to dryness, then heated to char the animal and vegetable matter, and the alkali will be recovered from it in the state of carbonate, by digesting the residuary ash in distilled water.

Ammonia. Sesquicarbonate of Ammonia.

The *vapour* of strong ammonia is poisonous. It may destroy life by producing violent inflammation of the larynx, or by causing pneumonia. It is often most injudiciously employed to rouse persons from a fit. A case is on record, of an epileptic having died, under all the symptoms of croup, two days after the application of strong ammonia, in this way, to the nostrils. A very singular case of recovery from the poisonous effects of this vapour, by Dr. Sanchard, will be found reported in the Annales d'Hygiène (Janvier, 1841.) The *solutions* of ammonia and its sesquicarbonate, produce symptoms similar to those described in speaking of potash. The only difference observed is, that the sense of heat and burning pain in the throat, fauces, and stomach, is much greater. Cases of this form of poisoning are rare. Dr. Sanchard relates an instance which occurred in France, where a boy, only six years old, poisoned his younger sister by pouring several teaspoonfuls of strong solution of ammonia down her throat. A case is likewise reported where a strong dose of the solution killed a man in *four minutes*. (Christison, 167.) Another case is referred to in the Journal de Pharmacie (Oct. 1846, p. 285,) in which from one to two drachms of ammonia, unknowingly administered, caused death. There was violent vomiting, with bloody stools; and, on inspection, blood was found effused in the intestines. There was also a remarkably fluid state of the blood in the body. In another instance, a man walked into a druggist's shop, and asked for a small quantity of ammonia to take some spots out of his clothes. The druggist poured about a teaspoonful and a half into a glass. The man suddenly swallowed it, and fell instantly to the ground. He soon afterwards died, complaining of the most excruciating pain. (Journal de Chimie Médicale, 1845, 531.)

Sesquicarbonate of ammonia.—The solution of this salt (sal volatile) is probably more active as a poison than is commonly supposed. The following case occurred to my knowledge in 1832. A man, in a fit of passion, swallowed about five fluid-drachms of a solution of sal volatile. In ten minutes, he was seized with stupor and insensibility; but, upon the application of stimulant remedies, he recovered. He suffered, for some time afterwards, from severe irritation about the fauces and œsophagus. Mr. Iliff, jun., reports the case of a little boy, aged two years, who swallowed about half an ounce of a strong solution of spirits of hartshorn, and in spite of some rather severe symptoms, recovered in a few days. (Lancet, Dec. 1, 1849.) These poisons are not often used by persons who are intent upon suicide or murder, but there is one instance on record in which a man was tried for the murder of a child by administering to it spirits of hartshorn. (*Reyina* v. *Haydon*, Somerset Spring Assizes, 1845.) Of the action of the other salts of ammonia on man, nothing is known.

The subjoined case lately occurred in the practice of Mr. Procter, of York. On

the 30th of May, 1852, a woman gave by mistake to her infant, four weeks old, a teaspoonful of hartshorn of the shops. The child soon afterwards breathed with difficulty—the skin was universally red—the pulse weak and feeble, and a frothy mucus issued from the mouth. The child became more and more depressed, and died thirty-six hours after taking the ammonia. There was no vomiting or diarrhœa, and the mouth and fauces presented no excoriation: there was, however, slightly increased redness of the lining membrane. A post-mortem examination was not made. The strength of the hartshorn used was found by Mr. Procter to amount to about nine per cent.

Chemical analysis.—The three caustic alkalies, potash, soda, and ammonia, are known from the solutions of the *alkaline earths* by the fact that they are not precipitated by a solution of carbonate of potash. They all three possess a powerful alkaline reaction on test paper, which, in the case of ammonia, is easily dissipated by heat. AMMONIA is immediately known from potash and soda by its odour and volatility. The SESQUICARBONATE OF AMMONIA may be known from other salts by its alkaline reaction, its odour, and its entire volatility as a solid:—from pure ammonia—1, by its effervescing on being added to an acid; 2, by its yielding an abundant white precipitate with a solution of chloride of calcium;—from the carbonates of potash and soda, among other properties,—1, by its giving no precipitate with a solution of the sulphate of magnesia; 2, from the rich violet blue solution which it forms when added in excess to the sulphate of copper; 3, by its odour and volatility.

CHAPTER IX.

METALLIC IRRITANT POISONS. ARSENIC—ARSENIOUS ACID—TASTE—SOLUBILITY IN VARIOUS LIQUIDS—SYMPTOMS—CHRONIC POISONING—ANOMALOUS CASES—POST-MORTEM APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—PERIOD AT WHICH DEATH TAKES PLACE—TREATMENT. CHEMICAL ANALYSIS—TESTS IN THE SOLID STATE—IN SOLUTION—MARSH'S PROCESS—REINSCH'S PROCESS—ARSENIC IN ORGANIC LIQUIDS—ABSORBED ARSENIC—ITS PRESENCE IN THE SOIL OF CEMETERIES—SULPHURETS OF ARSENIC AND OTHER COMPOUNDS.

ARSENIC. ARSENIOUS ACID.

General remarks.—The term WHITE ARSENIC is commonly applied to the arsenious acid of chemists. Arsenic acid is another compound which is highly poisonous, but has never, so far as I know, been used for the purposes of suicide or murder. YELLOW ARSENIC, or orpiment, is the sulphuret of chemists. This is also poisonous, apparently because it contains a large portion of arsenious acid uncombined with sulphur. This often amounts to from fifteen to twenty per cent. of its weight. Orpiment has been, on several recent occasions, criminally used as a poison. White arsenic, or arsenious acid, is, however, that preparation which chiefly requires the attention of a medical jurist. In the years 1837-8, there were one hundred and eighty-five cases of poisoning by this substance, the greater number of which were the result of suicide and murder.

Taste of arsenious acid.—White arsenic is commonly seen under the form of a white powder, or in opaque masses resembling enamel. It is called an acid from its power of combining with alkalies, but it possesses a very feeble acid reaction when dissolved in water. It is often described as having an *acrid taste*, but this does not appear to be correct: a small quantity of it has certainly no appreciable taste, a fact which may be established by direct experiment, and might be inferred from its very sparing solubility. It would appear from numerous cases

on record, that it has been unconsciously taken in fatal quantities, in all descriptions of food, without exciting the least sensation on the tongue. Most of those persons who have been criminally or accidentally poisoned by arsenic have not been aware of any taste in taking the poisoned substance. In other cases where the powder has been taken in *large* quantity it is described as having had a *roughish* taste.

Solubility of arsenic.—The *solubility* of this substance in liquids is a frequent question on trials. The action of water is materially influenced by circumstances. I have found by numerous experiments (Guy's Hospital Reports, No. 4, p. 81,) that hot water in cooling from 212° on the poison in powder, dissolves about the 400th part of its weight. This is in the proportion of nearly one grain and a quarter of white arsenic to about one fluid-ounce of water. Water boiled for an hour on the poison and allowed to cool, holds dissolved the 40th part of its weight, or about twelve grains in one ounce. Cold water allowed to stand for many hours on the poison, does not dissolve more than from the 1000th to the 500th part of its weight; *i. e.* one-half grain to one grain of arsenic to nearly one fluid-ounce of water. The presence of organic matter in a liquid renders the poison much less soluble.

[There seems to be a great want of agreement as to the solubility of arsenic in water. This is attributed in part to the different solubilities of the two kinds of arsenious acid, to the convertibility of the one into the other, and to the simultaneous occurrence of the two in one solution. Guibourt asserts that the opake acid dissolves in water more quickly and abundantly than the vitreous; while Bussy and some others assert the contrary. Bussy finds that the same quantity of water, which at 12° or 13° will take up 36 or 38 parts of the former, will not dissolve more than 12 or 14 of the latter. By long boiling with water, the opake acid is converted into the transparent variety—that is to say, it acquires the solubility of the latter. On the other hand, by the continued action of water and of a low temperature, the vitreous acid is rendered opake—that is to say, the solution, after awhile, becomes weaker, retaining only the proportion of acid which corresponds to the solubility of the opake. Comminution diminishes the solubility of the opake and increases that of the vitreous acid. (Compt. rend. 24, 774; Liebig and Kopp's Jahresbericht, 1847–8, 422; see Gmelin, Hand-Book, iv. 258.) Regnault says (Cours de Chimie, i. 320) that mechanical division transforms the vitreous into the opake variety; so that after having reduced the former to a very fine powder we find its solubility no greater than that of the latter. Dr. J. K. Mitchell and Mr. Durand, of Philadelphia, show, by their experiments, that the power of the solvent is influenced by the fineness of the powder, the time the fluid is in contact with the arsenic, and even the shape of the vessel in which the solution is made. They state that 1000 parts of temperate water will take up 12 to 16 of the acid of either variety, whilst the same proportion of boiling water will dissolve 148, and retain, on cooling, from 25 to 40, according to the time the boiling fluid is in contact with the arsenic. —H.]

Weight of Arsenic.—A medical witness is often asked the weight of common or familiar measures of arsenic in powder. I have found a teaspoonful of powdered arsenic to weigh 150 grains,—a tablespoonful to weigh 530 grains,—and a pinch, or the quantity taken up between the finger and thumb of an adult, to weigh 17 grains. These weights are here given as the results of actual experiment: but they are of course liable to some variation.

Symptoms.—These will vary according to the form and dose in which the poison has been administered. The *time* at which they come on is generally in from half an hour to an hour after the poison has been swallowed. This is the average period. I have known them to appear in a quarter of an hour. Dr. Christison mentions one instance in which the symptoms began in eight minutes; but in the case of *Lofthouse*, tried at the York Lent Assizes, 1835,

the symptoms were proved to have attacked the diseased, while he was in the act of eating the cake in which the poison was administered. On the other hand, in an instance communicated to me by Mr. Todd, where one drachm had been taken on an empty stomach, no symptoms appeared for two hours; in one reported by Orfila, the symptoms did not show themselves for five hours; and in another that occurred to Dr. Lachèse, in which a large dose was taken, the symptoms did not come on for seven hours. (Ann. d'Hyg. 1837, i. 344.) There may be every variety between these extremes. In one case their appearance was protracted for *ten* hours—the maximum period yet known. A very remarkable instance occurred to M. Tonnelier, in which the poison was taken by a young female at eleven o'clock in the morning, and no well marked symptoms occurred for *eight hours:* there was then violent vomiting. After death, a cyst, formed of mucous membrane and containing arsenic, was found in the stomach: the poison having thus become sheathed over! (Flandin, i. 535). See on this question the case of *Reg.* v. *Foster*, Bury Lent Assizes, 1847. In an interesting case communicated by Mr. Clegg to the Medical Times [Oct 21, 1848,] symptoms of violent irritation did not show themselves until twenty-three hours after the poison had been taken, and within about half an hour of the death of the patient. The girl was once sick shortly after having taken the poison, but the first symptoms were those of narcotism. The girl was a confirmed opium-eater, and this habit may in some measure have influenced the operation of the poison. A case has been recently communicated to the Medical Gazette by Dr. W. Burke Ryan, from which it appears that the active symptoms of irritation which commonly attend arsenical poisoning, may not appear until after the lapse of *nine hours* from the time at which the poison has been swallowed. With the exception of a case recorded in my work ON POISONS [page 317] in which the interval was ten hours, this is the longest period of protraction on record. In other instances there have been long intermissions. In all cases in which arsenic enters the system from without, as by its application to the skin and to ulcerated or diseased surfaces, the symptoms are rarely manifested until after the lapse of several hours.

Their nature.—The individual first experiences faintness, depression, nausea, and sickness, with an intense burning pain in the region of the stomach, increased by pressure. The pain in the abdomen becomes more and more severe; and there is violent vomiting of a brown turbid matter, mixed with mucus, and sometimes streaked with blood. These symptoms are followed by purging, which is more or less violent; and this is accompanied by severe cramps in the calves of the legs. The matters discharged from the stomach and bowels have had in some instances a yellowish colour, as it was supposed, from a partial conversion of the poison to sulphuret, but more probably from an admixture of bile. The vomited matters are in some cases coloured by blood,—and the mixture of blood with bile has often given to them an olive green or brown colour. In other cases, they may consist of a large quantity of mucus ejected in a flaky state, and having a milky-white appearance, as if from the admixture of white arsenic. The *colour* of the vomited matters has been hitherto much relied on as an aid to diagnosis; but it is necessary to direct the attention of practitioners to the probable effect of the new law on the sale of arsenic (14 Vic. cap. 13, sec. 3) in completely changing the appearance of the matters vomited by a person labouring under the effects of this poison. The sale of white arsenic in any quantity less than ten pounds is prohibited, unless it be mixed with 1-16th part of its weight of soot, or 1-32d part of its weight of indigo. The vomited matters may therefore be blue or black,—or the admixture of bile may render them of a deep green colour. In a case of arsenical poisoning recently communicated to me by Dr. Maclagan, the *blue* vomiting at first completely puzzled those who were called to render assistance. As soot and indigo are both insoluble in water, these substances will be slowly deposited from the vomited matters by subsidence, and the colour given by blood or bile may then become perceptible.

The vomiting is in general violent and incessant, and excited by any substance taken into the stomach. There is tenesmus (straining), and the discharges by the bowels are frequently tinged with blood. There is a sense of constriction, with a feeling of burning heat in the throat, commonly accompanied by the most intense thirst. The pulse is small, very frequent, and irregular; sometimes wholly imperceptible. The skin is cold and clammy in the stage of collapse; at other times it is very hot. The respiration is painful from the tender state of the abdominal parietes. Before death, coma sometimes supervenes, with paralysis, tetanic convulsions, or spasms in the muscles of the extremities. In one instance trismus (lock-jaw) appeared in three-quarters of an hour. (Orfila, i. 449.) Such is the ordinary character of the symptoms in an *acute* case of arsenical poisoning, *i. e.* where from half an ounce to an ounce of the poison has been taken.

Chronic poisoning.—Should the person recover from the first effects, and the case be protracted, or should the dose have been small and frequently administered, there will be an inflammation of the conjunctivæ, with suffusion of the eyes, and intolerance of light,—a condition which is, however, often present with the early symptoms above described. In a case reported by Mr. Jeffreys, an adult female died in three hours after taking arsenic in a pudding served at dinner. There was no vomiting or diarrhœa. In two hours she was in a state of complete collapse, and at this time it was noticed that the conjunctivæ (the membranes of the eyes) were red. (Med. Times, Aug. 30, 1851, p. 229.) There is also irritation of the skin, accompanied by a vesicular eruption, which has been called eczema arsenicale. Sometimes this has assumed the form of nettle-rash, or of the eruption attending scarlet fever, for which disease arsenical poisoning has been mistaken. Local paralysis, and other symptoms of nervous disorder, are also very common consequences. Exfoliation of the cuticle and skin of the tongue, with the falling off of the hair, has likewise been witnessed. (Case of the *Turners*, 1815, Marshall, 119.) Salivation has been observed to follow, especially when small doses of the poison have been given for a length of time, (Med. Gaz. xvi. 790.) Strangury and jaundice have been noticed among the secondary symptoms. (Marshall on Arsenic, 44, 111.) A well marked case of *slow poisoning* by arsenic is recorded by Flandin. (Traité des Poisons ou Toxicologie, Tom. i. p. 510.) It illustrates a not unfrequent form of *secret* murder, and it is well calculated to inspire caution in making a diagnosis from symptoms. A woman put daily into the soup of her fellow servant a very small quantity of arsenious acid in powder. Shortly after dinner, this person was seized with vomiting, which led to the rejection of the food and poison before the latter had caused any serious mischief. As this practice was continued for about six weeks, the stomach became exceedingly irritable; there was pain in the bowels, and the woman became much emaciated. There was also spitting of blood, with such a degree of nervous irritability, that a current of air falling upon her caused an attack of spasms and convulsions. When the patient found that she could not bear any thing on her stomach, she left the place and passed two months in the country. Her health became gradually re-established there, and she returned to resume her usual occupations. The prisoner, however, renewed her attempts; and, to make sure of destroying life, gave her one morning, in coffee, a strong dose of arsenious acid in powder: violent vomiting ensued, and the poison was expelled with the food taken at breakfast. Arsenic was detected in the vomited matter, and the explanation of the cause of the long previous illness then became clear. Under proper treatment the patient recovered. I believe this mode of poisoning to be more frequent in this country than is commonly supposed: and it behooves practitioners to be exceedingly guarded in their diagnosis, for the usual characters of arsenical poisoning are completely masked. They might be easily referred to chronic inflammation, or ulceration of the stomach leading to perforation. I have lately had to examine a case of this kind, where the death of a person had

been caused by his housekeeper under somewhat similar circumstances. The crime was not discovered until after the lapse of two years; and from the small dose given, and repeated vomiting during life, no arsenic could be detected in the body. There are many anomalous cases on record, in which the symptoms have diverged so much from the ordinary course as to embarrass medical practitioners. For some of these, I must refer to a paper by Dr. Ogston, Med. Gaz. vol. xlvii. p. 181; also to my work On Poisons, p. 320.

Post-mortem appearances.—The striking changes produced by arsenic are generally confined to the stomach and intestines. They are commonly well marked in proportion to the largeness of the dose and the length of time which the individual has survived after taking the poison. Our attention must be first directed to the *stomach*. Arsenic seems to have a specific effect on this organ; for, however the poison may have entered into the system—whether through a wounded or ulcerated surface, or by the act of deglutition—the stomach has been found inflamed. Inflammation of this organ cannot, then, be always considered to depend on the local irritant action of the poison on the stomach.

The mucous membrane of the stomach, which is often covered with a layer of mucus, mixed with blood, and with scattered white pasty-looking patches of arsenious acid, is commonly found red and inflamed: the colour, which is sometimes of a dull or brownish red, becomes brighter on exposure to the air: at other times it is of a deep crimson hue, interspersed with black-looking lines or dots of altered blood. The redness is usually most strongly marked at the greater extremity; in one case it may be found spread over the whole mucous surface, giving to it the appearance of red velvet, in another it will be chiefly seen on the prominences of the rugæ. Blood of a dark colour is effused in various parts between the rugæ, or beneath the lining membrane,—an appearance which has been mistaken for gangrene. [On this point see the case of The Queen against *Dore and Spry*, C. C. C., August 28, 1848; also Med. Gaz., Nov. 24, 1848.] The stomach often contains a mucous liquid of a dark colour tinged with blood. The coats are sometimes thickened in patches, being raised up into a sort of fungous-like tumour, with arsenic imbedded in them; at other times they have been found thinned. The mucous membrane is rarely ulcerated, and still more rarely gangrenous. Perforation of the coats is so uncommon a result of arsenical poisoning, that there are only three instances on record. The mucous glands of the stomach have been found enlarged; but this is by no means an unusual morbid appearance from any cause of local irritation, without reference to poisoning. Various morbid appearances are said to have been met with in the lungs, heart, brain, and urinary organs; but they do not appear to be characteristic of arsenical poisoning. It is undoubtedly to the stomach and intestines that a medical jurist must look for the basis of medical evidence in regard to post-mortem appearances.

Period required for inflammation.—A witness is often asked in a court of law how long a time is required, after the taking of arsenic, for the production of these well marked appearances in the stomach, especially of *inflammation* of the mucous membrane. In three cases communicated to me by Mr. Foster, of Huntingdon, death occurred in one, a child, at the end of *two hours;* in the second, an adult, at the end of *three hours and a half;* and in the third, after the lapse of about *six hours*. In each of these the stomach was found highly inflamed, and, in the one that proved fatal in two hours, the mucous membrane had a vermilion hue. This last I believe to be the shortest period at which inflammation of the stomach from the effects of arsenic has been met with.

Period required for ulceration.—Another question put to a witness may be this,—What period of time is required for *ulceration* of the mucous membrane to take place, as an effect of this poison? If arsenic has destroyed life with unusual rapidity, and the stomach is found ulcerated, an attempt may be made to refer this ulceration to some other cause. Such an attempt was made in the case

of *Rhymes*, which was the subject of a criminal trial in 1841. (Guy's Hospital Reports, Oct. 1841, p. 283.) I found ulceration of the mucous membrane, which had been completely removed in patches, although the deceased had survived the effects of the poison only *ten* hours. The deposition of the arsenic in and around the ulcers, as well as the appearance of recent inflammation about them, left no doubt that they had been produced by the poison, and were not owing to previous disease, as it was attempted to be urged in defence. Dr. Christison mentions a case observed by Mr. Hewson, where many eroded spots existed on the stomach, although the person died from the effects of arsenic in *five* hours. (On Poisons, p. 340.)

Absence of inflammation.—Are the stomach and intestines always found inflamed in cases of poisoning by arsenic? The answer must be decidedly in the negative. At the trial of *M'Cracken*, at the Derby Autumn Assizes, in 1832, for killing his wife with arsenic, the fact of poisoning was clearly established, and a large quantity of arsenic was found in the stomach of the deceased; but there was no appearance of inflammation, either in that organ or in the intestines. In a late number of Rust's Magazine, I find the two following cases. A servant-girl had some arsenic administered to her in chocolate. She was seized with nausea and violent pain in the stomach, and died the same evening. On inspection, there was no remarkable vascularity or inflammation of the stomach;—but arsenic was found in the duodenum. A man was taken ill with vomiting and violent pains in the abdomen after partaking of some soup, and he died from symptoms of poisoning. On inspection the mucous surface of the stomach presented no morbid change, with the exception of slight redness about the cardia. Arsenic was found in the contents of the intestines.

In a few rare instances, the mouth, pharynx, and œsophagus, have been found inflamed, but in general there are no post-mortem changes in this part of the alimentary canal to attract particular attention. The mucous membrane of the *small intestines* may be found inflamed throughout, but commonly the inflammatory redness is confined to the duodenum, especially to that part joining the pylorus. Of the large intestines, the rectum appears to be the most prone to inflammation. The heart, brain, and lungs, present no appearances which can be considered characteristic of arsenical poisoning. The same remark applies to the liver, spleen, and kidneys, although these, like the other soft organs, may become receptacles of the absorbed poison. It is worthy of remark in relation to the known antiseptic properties of arsenic, that the parts especially affected by this poison, (the stomach and intestines,) occasionally present the well marked characters of irritant poisoning for a long time after death. In two cases (*Chesham*) referred to me by Mr. Lewis, coroner for Essex, a deep red inflammatory appearance of the mucous membrane immediately below a layer of sulphuret of arsenic was well marked, although the bodies had been buried *nineteen* months. In a case which occurred in March, 1848, the stomach was also well preserved; and it retained an inflammatory redness after the lapse of *twelve* months. Absorbed arsenic does not, however, appear to prevent the decomposition of the body. For a very admirable summary of the post-mortem appearances caused by arsenic, I must refer the reader to a paper by my friend Dr. Geoghegan (See Medical Gazette, vol. xlvi. pages 171 and 218.)

Quantity required to destroy life.—This is an important medico-legal question. According to a case quoted by Dr. Christison, the smallest fatal dose on record, in an adult, is stated to have been *thirty* grains of the powdered white arsenic: the man died in six days. But undoubtedly a much smaller quantity than this would kill. Dr. Lachèse states that a dose of from one to two grains may act fatally in a few days:—this, however, is a speculative statement. (Ann. d'Hyg. 1837, i. 334.) It is highly probable that this dose would prove fatal to a child, or to weak and debilitated persons. The smallest fatal dose hitherto recorded, was observed in a case communicated by Dr. Castle, of Leeds, to the Provincial

Journal (June 28, 1848, page 347.) A woman took half an ounce of Fowler's solution, (Arsenite of Potash) in unknown doses, during a period of five days. She then died: and on examination the stomach and intestines were found inflamed. Death took place by syncope, (mortal fainting) and there was an absence of vomiting and diarrhœa. The quantity of arsenic which here destroyed life could not have been more than *two grains*. In another case—two grains and a half of arsenic, contained in two ounces of Fly-water, killed a robust healthy girl, aged nineteen, in thirty-six hours. (See Med. Gaz., vol. xxxix. p. 116.) Hence a medical witness will be justified in stating that under circumstances favourable to its operation, the fatal dose of this poison in an adult is from *two to three grains*.

Period at which death takes place.—Some remarks on the important bearing which an answer to this question may have in a case of arsenical poisoning, have been elsewhere made (ante, p. 46.) From the numerous well observed cases which are now on record it would appear that large doses of arsenic commonly prove fatal in from eighteen hours to three days. Probably, the average time at which death takes place is twenty-four hours; but the poison may destroy life within a much shorter period than this. There are now many authentic cases reported, in which death has occurred in from three to six hours. In 1845 I met with a well marked case of death from arsenic in five hours, and in another, which occurred in April, 1849, death took place in two and a half hours. (Guy's Hospital Reports, Oct. 1850, 183. See also Ann. d'Hyg. 1837, i. 339.) It is singular that a few years since, observations were so limited that it was thought to be impossible that arsenic could destroy life in a shorter period of time than seven hours! (See ante, p. 46, *Russell's case;*) and this rapidity of death was actually considered as a medical fact, which in some measure tended to negative the allegation of death from arsenic! One of the most rapidly fatal cases on record I believe to be that which occurred to Mr. Foster, of Huntingdon. This gentleman satisfactorily ascertained that the subject, a child under three years of age, died within *two hours* from the effects of arsenic. The quantity taken could not be determined; but the time at which death takes place is by no means dependent on the quantity of poison taken. Dr. Borland, who formerly attended my lectures, communicated to me a case, in which death probably occurred in less than two hours. An interesting case has been published by Dr. Dymock. A girl, aged twenty, took two ounces of powdered arsenic, and died in less than *two hours and a half* afterwards. There were no comatose symptoms;—the girl was sensible to the last, and she had vomited violently. The mucous membrane of the stomach was covered with bright patches of a scarlet colour. (Ed. Med. and Surg. Journ. April, 1843.) In some instances death does not occur until long after the average period. In one case, in which an adult swallowed about half an ounce, death did not take place for *fifty hours*, and it is remarkable that there was an entire absence of pain (Med. Gaz. vol. xlviii. page 446.) In the case of the *Duke de Praslin*, one large dose was taken, but death did not occur until the *sixth* day. (Ann. d'Hyg. 1847, ii. 367.) In October, 1847, a man who had swallowed 220 grains of arsenic, was admitted into Guy's Hospital. He died on the *seventh* day. It is obvious that a patient who recovers from the first effects of this poison may still die from exhaustion or other secondary causes, many days or weeks after having taken it. In the case of *Reg.* v. *M'Cormick*, Liverpool Winter Assizes, the child died, as it appeared, from one dose of arsenic after the lapse of twelve days. (Med. Gaz. xxxiii. 434.) The child partially recovered from the first effects. In the case of The *Queen* v. *Gilmour* (Edinburgh, Jan. 1844,) the deceased died after thirteen days. In one instance, arsenic was applied externally to the head, and the person did not die until the *twentieth day*. The longest duration of a case of poisoning by arsenic which I have met with is reported by Belloc. A woman, aged 56, employed a solution of arsenic in water to cure the itch, which had resisted

the usual remedies. The skin became covered with an erysipelatous eruption, and the itch was cured, but she experienced severe suffering. Her health gradually failed, and she died after the lapse of *two years*, having suffered during the whole of this period from a general tremor of the limbs. (Cours de Méd. Lég. 121.)

Chemical analysis.—Arsenic as a solid. In the simple state, *White arsenic* may be identified by the following properties:—1. A small quantity of the powder, placed on platina foil, is entirely volatilized at a gentle heat (370°) in a white vapour. Should there be any residue, it is impurity; sometimes plaster of Paris or chalk is found mixed with it. The quantity of fixed impurity present may in this way be easily determined. If a small portion of the white powder be very gently heated in a glass tube of narrow bore, it will be sublimed without melting, and form a ring of minute octahedral crystals, remarkable for their lustre and brilliancy. It will be observed in these experiments, that white arsenic in vapour possesses no odour. 2. On boiling a small quantity of the powder in distilled water, it is not dissolved, but it partly floats in a sort of film, or becomes aggregated in small lumps at the bottom of the vessel. It requires long boiling, in order that it should become dissolved and equally diffused through water. 3. When the powder is treated with a solution of hydrosulphuret of ammonia in a watch-glass, there is no change of colour, as there is with most metallic poisons: on heating the mixture, the white powder is dissolved; and on continuing the heat until the ammonia is expelled, a rich yellow or orange-red film is left (sesquisulphuret of arsenic,) which is soluble in all alkalies, and insoluble in muriatic acid.

Reduction-process.—When a small portion of the powder, *i. e.* from one-fourth to one-twentieth part of a grain, is heated with some reducing agent containing carbon (and the best for this purpose is a flux obtained by incinerating acetate of soda in a close vessel) in a glass tube about three inches long and one-eighth of an inch in diameter, it is decomposed: a ring of metallic arsenic of an iron-gray colour is sublimed and deposited in a cool part of the tube. At the same time there is a perceptible odour, resembling that of garlic, which is possessed by metallic arsenic only while passing from a state of vapour to arsenious acid. This *odour* was at one time looked upon as peculiar to arsenic, but no reliance is now placed on it as a matter of medical evidence—it is a mere accessary result. In this experiment of reduction, there are commonly two rings deposited in the tube:—the upper ring has a brown colour, and appears to be a mixture of finely divided metallic arsenic and arsenious acid. In order to determine the *weight of the sublimate*, the glass tube should be filed off closely on each side of the metallic ring, and weighed; the sublimate may then be driven off by heat, and the piece of glass again weighed:—the difference or loss represents the weight of the sublimate. These sublimates are remarkably light, and require to be weighed in a delicate balance. I found, in one experiment, a large sublimate to weigh no more than ·08 grains. By heating gently the piece of tube, reduced to powder, in another tube of larger diameter, the metallic arsenic, during volatilization, forms octahedral crystals of arsenious acid, which may be dissolved in a few drops of water, and tested by the liquid reagents. The metallic sublimate, or the crystals produced from it, may be subjected to the following process, in order to determine their real nature:—Break the glass on which the sublimate is deposited into fragments, and digest these in a few drops of strong nitric acid. The sublimate, if due to arsenic, is converted to arsenic acid. The acid solution should be evaporated to dryness; the white uncrystalline residue dissolved in a few drops of distilled water, and a solution of nitrate of silver added. A brick-red precipitate indicates arsenic acid, and thereby proves that the sublimate was of an arsenical nature.

Objections to the Reduction-process.—1. The glass itself may acquire a black metallic lustre by heat from the reduction of the *oxide of lead* contained in it.

This is always the case when the tube is held too much in the body of the spirit-lamp flame instead of over the point. This metallic stain differs in appearance from arsenic; it is fixed, while the arsenical sublimate is volatile by heat, and convertible to white octahedral crystals of arsenious acid. 2. *Charcoal* may give a dark colour to the tube, but it is not advisable to employ this substance unless the quantity of arsenious acid is very minute; besides the stain of charcoal is fixed, and has no metallic lustre like that of arsenic. 3. Arsenic is said to be contained in *glass*, and it was supposed that it might be sublimed by heat: this, however, is impossible; arsenic is sometimes used in the manufacture of glass, but it is entirely volatilized during the process. (See Ann. d'Hyg. 1834, i. 224; also Galtier, Toxicologie, i. 297.) I have frequently examined large quantities of the glass tubing employed by chemists in a finely powdered state, without finding the slightest trace of arsenic. 4. *Cadmium* is a metal which is said to form a metallic sublimate like arsenic. The oxide of cadmium may be reduced by a similar process, but the metallic sublimate is wholly different from that of arsenic: it has a tin-like lustre, and is generally fringed with a brown margin of reproduced oxide. There is no odour of garlic during the reduction of oxide of cadmium; and, on heating the metallic ring, it is not wholly volatilized like arsenic, but converted to a ring of brown oxide. 5. *Mercury* forms a sublimate, but in white silvery globules, quite distinct from the dark iron-gray lustre of arsenic. Neither antimony nor zinc can be volatilized from any of their preparations in a metallic state, by the heat of a spirit lamp. The *process of reduction*, with the most simple precautions, is, therefore, when thus applied, conclusive of the nature of the substance under examination. It is advisable, although not absolutely necessary, that we should apply the three foregoing tests to the white powder, before attempting to extract the metal from it.

Arsenic in solution in water; Liquid tests.—The solution is clear, colourless, possesses scarcely any perceptible taste, and has a very faint acid reaction. In this state, we should first evaporate slowly a few drops on a glass plate, when a confused crystalline crust will be obtained. On examining this crust with a common lens, it will be found to consist of numerous minute octahedral crystals, presenting triangular surfaces by reflected light. By this simple experiment, arsenic is distinguished from every other metallic poison. Under a good achromatic microscope, it is easy to determine the form of a crystal which has only the 1·4000th of an inch in diameter.

1. On adding to the solution *Ammonio-nitrate of silver*, a rich yellow precipitate of arsenite of silver falls down;—rapidly changing in colour, under exposure to daylight, to a greenish brown hue. The test is made by adding to a very strong solution of nitrate of silver a weak solution of ammonia, continuing to add the latter, until the brown oxide of silver, at first thrown down, is almost redissolved. The yellow precipitate is soluble in nitric, tartaric, citric, and acetic acids, as well as in caustic ammonia. It is not dissolved by potash or soda.

2. On adding to the solution of arsenic *Ammonio-sulphate of copper*, a rich green precipitate is formed, the tint of which varies according to the proportion of arsenic present, and the quantity of the test added: hence, if the quantity of arsenic be small, no green precipitate at first appears; the liquid simply acquiring a blue colour from the test. In less than an hour, if arsenic be present, a bright green deposit is formed, which may be easily separated from the blue liquid by filtration. This test is made by adding ammonia to a weak solution of sulphate of copper, until the bluish white precipitate, at first produced, is nearly re-dissolved: it should not be used in large quantity if concentrated, as it possesses a deep violet blue colour, which completely obscures or conceals the green precipitate formed. The precipitated arsenite of copper is soluble in all acids, mineral and vegetable, and in ammonia, but not in potash or soda. When dried and collected, it possesses this characteristic property: by very slowly heating a few grains in a tube of small bore, arsenious acid is sublimed in a ring of minute resplendent octahedral crystals, oxide of copper being left as a residue.

8. *Sulphuretted hydrogen gas.*—The hydrosulphuret of ammonia gives no precipitate in a solution of arsenic until an acid has been added, whereby arsenic is known from most metallic poisons. On adding an acid (acetic or dilute hydrochloric,) a rich golden yellow-coloured precipitate is thrown down (orpiment or sulphuret of arsenic.) It is better, however, to employ in medico-legal analyses, a current of washed sulphuretted hydrogen gas, which is easily procured by adding sulphuret of iron to one part of strong sulphuric acid and three parts of *water* in a long-necked bottle. The arsenical liquid should be slightly acidulated with acetic or very diluted muriatic acid, *before* the gas is passed into it; at least care should be taken that it is not alkaline. The yellow compound is immediately produced if arsenic be present, and may be collected after boiling the liquid sufficiently to drive off any surplus gas. The precipitation is likewise facilitated by adding to the liquid a solution of muriate of ammonia. This yellow precipitate is known to be sulphuret of *arsenic* by the following properties:—1. It is insoluble in water, alcohol, and ether, as well as in all acids, mineral (muriatic) and vegetable; but it is decomposed by strong nitric and nitro-muriatic acids. 2. It is immediately dissolved by caustic potash, soda, or ammonia; forming, if no organic matter be present, a colourless solution. 3. When dried and heated with three parts of soda-flux, or, what is better, an equal part of cyanide of potassium, it furnishes a metallic sublimate of arsenic. This last experiment requires a little care, as some sulphur is apt to be sublimed, and obscure the results. If fine pulverulent silver be used as the reducing agent, and the heat *gently* applied, the arsenic may be evolved at once from the sulphuret, in a ring of octahedral crystals of arsenious acid. 4. The arsenical nature of the yellow precipitate may be also conclusively proved by heating it with a mixture of one part nitric and two parts hydrochloric acid, and evaporating to dryness. A residue of arsenic acid is thus obtained, which, when dissolved in a few drops of distilled water, and tested by nitrate or ammonio-nitrate of silver, yields a brick-red precipitate of arseniate of silver. Unless two or more of these properties are proved to be possessed by the yellow precipitate formed by sulphuretted hydrogen in an unknown liquid, it cannot be a compound of arsenic; and it would not be safe as a general rule to receive evidence on the point. On the other hand, when these properties (especially 3 and 4) are possessed by the precipitate, it must be arsenic, and can be no other substance.

Objections.—Many objections have been taken on criminal trials to the medical evidence, founded on the application of these tests *individually;* but it may be safely averred that there is no substance except arsenic which will give the reactions with the three. It is customary for toxicologists to lay down the rule, that the objection urged against one test for arsenic is removed by the application of the other tests. In a criminal case in which I was required to give evidence (*Reg.* v. *Jennings*, Berks Lent Ass. 1845,) it was ingeniously suggested in the defence, that there might perchance be such a mixture of substances not containing arsenic, as to affect all the tests like arsenic when separately applied. This, however, is clearly a chemical impossibility, for it would require the mixture of substances incompatible with each other. But a mere change of colour, or even the production of a coloured precipitate on adding a test to an unknown liquid, furnishes no evidence, *unless the properties of the precipitate be those of an arsenical compound.* Again, no conceivable mixture of substances would produce a metallic ring resembling that of arsenic, so as to deceive an analyst experienced in such matters; and far less a ring, possessing those properties of an arsenical sublimate, which it would be easy for one who may have had but little experience, to determine by simple chemical processes.

Marsh's process. Hydrogen test.—The action of this test depends on the decomposition of arsenious acid and its soluble compounds, by hydrogen evolved in the nascent state from the action of diluted sulphuric acid on zinc. The apparatus is of the most simple kind, and is so well known as to need no descrip-

tion. The arsenic may be introduced into the short leg of the tube in the state of powder; but it is far better to dissolve it in water, by boiling, either with or without the addition of a few drops of caustic potash. The metallic arsenic combines with the hydrogen, forming arsenuretted hydrogen gas, which possesses the following properties:—1. It burns with a bluish-white flame, and thick white smoke (arsenious acid.) 2. A cold plate of glass or white porcelain held in the flame near the point, receives a dark stain from the deposit of arsenic upon it. This stain is composed in the centre of pure metallic arsenic, which may be sometimes raised up in a distinctly bright leaf of metal,—immediately on the outside of this, is an opake black ring (suboxide or hydruret of arsenic,) which, when viewed by transmitted light, is of a clear hair-brown colour at the extreme edge:—if the quantity of arsenic be very small, the metallic lustre and opacity may be wanting, and the whole stain will have a brown colour by transmitted light. On the outside of this black ring is a thin wide film of a milk-white appearance, which is nothing more than arsenious acid reproduced by combustion. 3. A white saucer or a slip of card or paper moistened with ammonio-nitrate of silver, held about an inch above the point of the flame, will be found, if arsenic be present, to be coloured yellow, from the reproduced arsenious acid being absorbed, and forming yellow arsenite of silver, easily soluble in acetic acid and ammonia. 4. Nitrate of silver on paper is immediately blackened and reduced by the unignited gas. Unless the gas possess these properties, there is no certain evidence of the presence of arsenic in the liquid examined.

Objections to Marsh's process.—Other substances will combine with hydrogen, and when the gas is burnt, a deposit will be formed on glass which may be mistaken for arsenic. The only objection of any practical force is that founded on the presence of *antimony*. There are these differences between the arsenical and antimonial deposits: the deposit of antimony has rarely the bright metallic lustre which that of arsenic commonly presents; by transmitted light it is of a smoky black, while that of arsenic is of a hair brown colour. Although the antimonial is very similar in colour to the arsenical flame, yet the third property is entirely wanting. If the ammonio-nitrate of silver be held over the antimonial flame, the silver is reduced; no yellow arsenite is formed, as in the case of arsenic. This last criterion distinguishes the arsenical flame from that produced by all the other bodies above mentioned. The arsenical *deposit* may be further distinguished by dissolving it in nitric acid, evaporating to dryness, and adding nitrate of silver. A brick-red precipitate is formed if the stain have been caused by arsenic.

Arsenic is sometimes contained as an *impurity* in zinc and sulphuric acid: hence the purity of the materials employed must be determined before any reliance can be placed on the results.

Reinsch's process.—In the application of this ingenious process, the liquid suspected to contain arsenic, or the solid dissolved in distilled water, is boiled with about one-sixth to one-eighth part of pure muriatic acid, and a small slip of bright copper foil or copper gauze is then introduced. If arsenic be present, even in small quantity, the copper acquires either immediately or within a few minutes a dark iron-gray coating from the deposit of that metal. This is apt to scale off, if the arsenic be in large quantity, or if the liquid be long boiled. We remove the slip of copper, wash it in water, dry it, and gradually heat it in a reduction-tube, when arsenious acid will be sublimed in minute octahedral crystals: if these should not be apparent from one piece of copper, several may be successively introduced. A large surface of copper may be in this way at once covered—the gray deposit scraped off, and the powder gently heated in a reduction-tube. This test succeeds perfectly with powdered arsenic, the arsenites, arsenic acid, the arseniates, and orpiment; but, as it has been shown by Dr. Rainey, its operation is not so delicate or certain with arsenic acid and the arseniates as with the other compounds of arsenic. This process will even separate the arsenic from the arsenite of copper, and from common lead-shot. When the quantity of arsenic

is small, the polished copper merely acquires a faint violet or bluish tint, and the deposit is materially affected by the quantity of water present, or, in other words, the degree of dilution. But one great advantage is, that we are not obliged to dilute the liquid in the experiment, and there is no material loss of arsenic, as in the hydrogen process:—the whole may be removed and collected by the introduction of successive portions of copper. This process is extremely delicate, the results are very speedily obtained, and are highly satisfactory. One caution is to be observed, *i. e.* not to remove the copper from the liquid too soon. When the arsenic is in minute quantity, and the liquid much diluted, the deposit does not take place sometimes for half an hour. If the copper be kept in for an hour or longer, it may acquire a dingy tarnish from the action of the acid only. This is known by its want of metallic lustre, and its being easily removed by friction, as well as by its yielding no crystalline sublimate when heated.

Objections to Reinsch's process.—Certain objections have been urged to this test. Thus arsenic may be present in the muriatic acid: this is at once answered by boiling the copper in a portion of the muriatic acid before adding the suspected liquid. This should always be a preliminary experiment. A more important objection is, that other metals are liable to be deposited on copper under similar circumstances. Thus, this is the case with *Antimony*, whether in the state of chloride or of tartar-emetic; and it is not always possible to distinguish, by the appearance, the antimonial from the arsenical deposit. Should the quantity of antimony be small, the deposit is of a violet tint; if large, of an iron-gray colour, exactly like arsenic. There is one answer to these objections, namely, that from the arsenical deposit, octahedral crystals of arsenious acid may be procured by *slowly* heating either the slip of copper, or the gray deposit scraped from it, in a reduction-tube. If this experiment be carefully performed, a ring of white arsenious acid will be easily obtained: this may be boiled in a few drops of water, and tested with the ammonio-nitrate of silver and sulphuretted hydrogen. When the sublimates are too small for such a solution and subdivision, they may be converted to arsenic acid, by digestion in nitric acid, by the process already described (ante, page 83,) and the residue tested for arsenic acid by nitrate of silver. Such a corroboration is necessary, because the crystalline form of arsenious acid is not always distinguishable by the eye; and the antimonial deposit gives a white amorphous sublimate, which, however, is quite insoluble in water. Care must be taken not to mistake minute spherules of water or muriatic acid for detached crystals of arsenious acid, and here the microscope will be found of great service. The facility of applying Reinsch's process renders it necessary that the experimentalist should be guarded in his inferences. It is not merely by the production of a deposit on copper, that he judges of the presence of arsenic, but by the conversion of this deposit to arsenious acid, demonstrable by its crystalline form or its chemical properties. If a deposit take place on copper, and arsenious acid cannot be obtained by heating it, then the evidence of its having been caused by arsenic is defective. Owing to the neglect of these corroborative results, antimony and other substances have been mistaken for arsenic.

Arsenic in liquids containing organic matter.—Arsenious acid, when in a state of solution, is not liable to be precipitated by any animal or vegetable principles, although all such substances render it less soluble in water. It has been recently announced that it enters into combination with albumen, but this is a point of no practical importance in reference to the present subject of inquiry. The liquid for analysis should be filtered through muslin, cotton, or paper, in order to separate any insoluble matters: these should be well pressed and drained. Should the liquid be coloured, this is of little moment, provided it be clear. If viscid, it should be diluted with water and boiled with a small quantity of muriatic acid; on standing, a deposit may take place, and this should be separated by a filter. As a trial-test, we may now boil in a portion of the liquid, strongly

acidulated with pure muriatic acid, a slip of bright copper, or introduce a piece of fine copper-wire highly polished. In a few seconds, if arsenic be present, the copper will acquire a gray metallic coating. If, after half an hour, the copper remain unchanged, the arsenic, if present, must be in extremely minute proportion; if, on the other hand, the copper be covered by a gray deposit, it should be dried and heated in a reduction-tube in the way already described, in order to obtain from it octahedral crystals of arsenious acid, the nature of which must be subsequently demonstrated by the special mode of examination already pointed out. From several such slips of copper, or copper-gauze, *i. e.* very finely woven copper-wire, a quantity of metallic arsenic may be procured, sufficient, on reconversion to arsenious acid, to allow of a solution in water being made, to which all the liquid tests may be applied. If the quantity thus procured be small, the arsenious acid may be converted to arsenic acid by nitric acid (see p. 83.) Unless a brick-red precipitate result, under due precautions, on the addition of nitrate of silver, we cannot be certain that the sublimate was owing to arsenic. One obstacle to the use of the gauze is, that oily and other kinds of animal matter, not easily removable by washing in water, may adhere to it. Digestion in ether and alcohol, slightly warmed, will free it from these substances, which are apt to become sublimed by heat, and obscure the arsenic:—but it should be again washed in water and dried before heat is applied to it. When, however, much oily matter is present, it is better to boil the organic substance with muriatic acid, and filter the liquid through a *wet filter* before introducing the copper-gauze. In this way the fat and solid organic impurities may be separated. An even coating of arsenic was by this process obtained on copper-gauze from the decomposed tissue of the stomach of a person whose body had been buried nearly two years. As the gauze, from its extreme fineness, is remarkably hygrometric, it requires to be thoroughly dried in a vapour-bath before it is submitted to heat in a reduction-tube. Should there be any doubt whether the sublimate be caused by spherules of liquid or particles of arsenic, the tube itself should be kept some time in a vapour-bath. Water is dissipated at 212°. Arsenious acid requires a heat of nearly 370° for its sublimation. In order to avoid the possibility of a mistake, when the sublimate is very minute, and of a doubtful character, it will be advisable to examine it with a good microscope, under a power of one hundred and forty diameters. If arsenic, it will present itself in minute detached angular crystals, having triangular surfaces, and more or less of an octahedral form. Globules of water, or of hydrochloric acid, present themselves in rounded or oblong spots, transparent in the centre, and dark at the circumference. They may thus be seen among, and easily distinguished from, the crystals of arsenic, in ordinary sublimates. In a fine sublimate, derived from some hay in the stomach of a horse that had been killed by arsenic, I counted twenty-eight distinct crystals of arsenic, in a space the 1-200th of an inch square. The greater number of these crystals had a diameter of the 1-2000th of an inch; some were distinctly recognised which had a diameter of less than 1-4000th of an inch. In general the octahedra are truncated.

Another process for procuring evidence of the presence of this poison in liquids, consists in precipitating the arsenious acid in the state of sulphuret, and in decomposing this compound by an alkaline flux to obtain metallic arsenic, or by nitromuriatic acid, to obtain arsenic acid. Sulphuretted hydrogen gas should be passed into the suspected liquid, previously filtered and acidulated with muriatic or acetic acid. When all further precipitation has ceased, the liquid should be filtered, the precipitate collected, dissolved in ammonia, and reprecipitated by an acid. By digesting it in water, alcohol, and muriatic acid successively, it may be deprived of any organic matter combined with it, sufficiently to allow of its reduction by soda-flux or metallic silver in the way described. The sulphuret has sometimes a dark brown colour from adhering organic matter; it is then better to transform it to arsenic acid by boiling it in nitro-muriatic

acid, and slowly evaporating the acid liquid to dryness: during this process, the organic matter is entirely destroyed, and a dry residue of arsenic acid is obtained and rendered fit for testing, by digesting it in distilled water; or the sulphuret may be deflagrated with nitre, and arseniate of potash then procured. In this case the surplus nitric acid should be driven off by sulphuric acid. An abundant deposit of metallic arsenic may be obtained in either case by boiling the liquid with muriatic acid and copper-gauze. In this way it is easy to analyze wine, coffee, tea, milk, porter, brandy, and similar liquids, for arsenic. This corroborative test is necessary, since I have known an instance in which a large quantity of orange-peel had been eaten and had caused death, and the contents of the stomach acquired a yellow colour from sulphuretted hydrogen gas, like that produced by arsenic. There was no deposit, and the yellow colour did not disappear on adding ammonia.

The *contents of the stomach* are often mixed with lumps of arsenic which may be separated by throwing those portions that do not pass through a filter into a large glass of distilled water, and after giving to it a circular motion, suddenly pouring off the supernatant liquid, when the heavy portions containing arsenic will be found at the bottom. The lumps left in the contents may be easily removed, dried on filtering paper, and tested. If the arsenic has been taken in fine powder, there will be no lumps, but it will probably be deposited in masses, mixed with mucus and blood, on the coats of the organ, chiefly in those parts where it is much inflamed and ulcerated. The arsenic in this state looks like moistened plaster of Paris, but it is of a darker colour, and when examined by a lens it is crystalline. It may be removed on a spatula, spread in masses on filtering paper, and slowly dried. As it dries, the granules will detach themselves from the mass, and they may be then easily tested either by the Reduction or by Reinsch's process; *i. e.* by boiling the suspected particles, or even the stained portions of paper on which the organic matter has become dried, with muriatic acid and copper-gauze. Mucus, blood, or even a layer of the mucous membrane of the stomach, may be thus readily tested. This is in general the only method which it is now necessary to employ. By the use of numerous tests and processes, a witness only exposes his evidence most unnecessarily to many ingenious objections. It is sufficient, after having obtained a metallic deposit on copper, to procure from it crystals of arsenious acid, and to demonstrate that they are really this substance, by dissolving them in water, and applying the liquid tests, or in nitric acid, and applying to the evaporated residue either the nitrate or the ammonio-nitrate of silver. It is necessary to remark in reference to the application of the last-mentioned process, that there should be no free acid present, because the arseniate of silver is very soluble in acids. The ammonio-nitrate of silver may be sometimes, therefore, advantageously substituted for the simple nitrate.

In forming a judgment of the *quantity* of arsenic procured by Reinsch's process, it may be stated that only *three-fifths* of the arsenious acid employed are obtained in crystals by heating the copper. My friend, Dr. Geoghegan, of Dublin, has lately published some very interesting observations on this subject, for an account of which I must refer the reader to his paper in the Dublin Quarterly Journal for February, 1851. He has found that while the *whole* of the arsenic is deposited, but little more than one half can be re-obtained by sublimation in the crystalline state.

Since the publication of the previous edition of this work, Dr. Maclagan of Edinburgh, and Dr. Rainey of Glasgow, have added many valuable facts regarding the application of Reinsch's process in the detection of arsenic when mixed with organic matters. Dr. Rainey finds that 1-1000th of a grain of arsenious acid will give a full steel colour to one square inch of copper-surface, and he properly advises the analyst not to waste the arsenic, (when present in small quantity) by spreading it in a thin film over too large a surface of copper. (See Proceedings

of Glasgow Phil. Soc., December, 1849.) For Dr. Maclagan's practical remarks on the same subject, I must refer the reader to the Edinburgh Journal of Medical Science for 1848–9.

A plan which I have lately found convenient for preliminary testing is to introduce a loop of fine and highly polished copper-wire into the boiling acid liquid:—the two ends of the wire resting on the edges of the basin or glass vessel, as a support, and for the convenience of occasional examination. So soon as a closely adhering steel-coloured deposit appears on the copper the loop of wire is removed, and small pieces of finely-woven copper-gauze, containing 16000 apertures to the square inch, and therefore presenting a comparatively large surface for deposit, are *successively* introduced until they cease to be coated. From one or more of these pieces, crystals are obtained, and their nature proved by the process above described.

When arsenic is discovered in the stomach mixed with food, it does not necessarily follow that it has been administered in that particular article of food. Should the person have partaken of food, such as milk or gruel, subsequently to the swallowing of arsenic, these fluids will necessarily acquire an arsenical impregnation from the poison contained in the stomach. The patients may have taken the arsenic in one kind of food, when another and an innocent description of food might thus inadvertently be pronounced to have been the vehicle.

It is unnecessary in this place to enter into a comparison of the two processes above noticed, in respect to their relative powers of enabling the analyst to detect minute quantities of arsenic. It may be conceded that Marsh's process will detect a smaller quantity of arsenic than the process of Reinsch, but the latter, when the quantity of liquid is small, will detect the 1-150th part of a grain of the poison, and this is itself a point of delicacy in analysis, which, when the issues of life and death are involved, might almost suffice to justify a reasonable distrust of the resources of science. It would require considerable courage to go beyond this, and it appears to me that in a criminal case it would not be safe to depose to the presence of arsenic from Marsh's process alone, when the quantity of poison was *too small* to admit of separation or detection by the process of Reinsch. When the point of detection by Reinsch's process has been passed, then we increase the chance of fallacy to which Marsh's process is always exposed, by the fact that such minute traces of arsenic may have existed in some portion of the zinc or sulphuric acid employed. It was this over-reliance on the extreme delicacy of the test in degrees of research where the process admitted of no corroboration whatever, that led to the great error committed by Orfila of asserting that arsenic was a *natural constituent of the human body!* [Several papers on the detection of arsenic, when mixed with the contents of the stomach, have appeared in this country, and may be consulted with advantage; as Am. Journ. Med. Sci. ix. 524; xvi. 240. Phil. Journ. Pharm. vi. 94, 190. Trans. Mar. Acad. vol. i. pt. 1. Hays' Amer. Med. Cycloped., art. Arsenic. Philad. Med. Ex., 1851, vol. vii. 153.]

Detection of absorbed acid in the tissues.—When arsenic cannot be detected in the contents of the viscera, it is necessary to adopt some method of extracting from the blood, secretions, muscles, or viscera of the deceased, that portion of the poison which has been *absorbed*. In most cases of acute poisoning, arsenic will be found, but in variable quantities, in every one of the soft structures of the body—more abundantly in the viscera of the abdomen than elsewhere.

The processes commonly employed for the discovery of arsenic in the tissues are those of MM. Danger and Flandin, and of Reinsch.

1. MM. Danger and Flandin carbonize the animal matter by boiling it to dryness in a small quantity of strong sulphuric acid, equal to about one-third the weight of the dried organic matter. They digest the resulting carbonaceous ash in nitro-muriatic acid, and after driving off the acid by a moderate heat, treat the residue with distilled water. This, if arsenic be present in the viscera, yields arsenic acid,—a compound the nature of which may be easily demonstrated (page

83.) In pursuing this process, I obtained, from seven ounces of the liver of a man poisoned by arsenic, about a dozen minute sublimates, as well as the action of the vapour of the flame on ammonio-nitrate of silver. M. Blondlot has lately advised that the carbonization should not be carried to *dryness*, as it occasions a loss of arsenic; but when the liquid is of a pasty consistency, he passes into it a current of chlorine; the liquid is then filtered, and introduced into Marsh's apparatus, where it produces but little froth. (Comptes Rendus, 1845, ii. 32.) There can be no doubt that by the use of nitro-muriatic instead of nitric acid, a portion of the arsenic is volatilized as chloride.

2. The process of Reinsch is, however, more easily applied than that of M. Flandin: it is simply this. The soft organs (and for this purpose the liver is preferable) are to be cut into very small pieces, and boiled in a mixture of one part of pure muriatic acid and eight of water, for two hours, or until the whole of the organic matter becomes a soft magma. The liquid may then be strained, and the residue pressed. If the quantity be large, it may be concentrated by evaporation. The copper-gauze, foil, or fine wire, should be next introduced, the acid liquid boiled, and half an hour or an hour allowed for the deposit, if necessary. Should a deposit be formed, its nature must be positively determined in the way already described (p. 86.) I have had occasion to apply this process to the detection of absorbed arsenic in the tissues in numerous cases of arsenical poisoning, with the most satisfactory results. A witness, in making use of it, must always be prepared to meet with the following objection—namely whether a deposit resembling that of arsenic may not be formed on the surface of copper by long boiling with animal matter (free from poison) and muriatic acid. Having tried on several occasions the liquid contents of the human stomach, the viscera, and even common muscle (beef,) as well as various articles of food, in order to determine this point,—the result has been, that except when arsenic was added, or when there was a very strong suspicion of its presence, no metallic deposit was formed on the copper. The metal came out of the vessel *untarnished*, or there was only a slight superficial discoloration (from oxide or subchloride) easily removed by friction. It would be wrong, however, to say, whatever suspicions may exist, that arsenic was present in any case, unless arsenious acid be obtained from the deposit. The analyst should remember that the liver, spleen, and kidneys, are the organs best fitted for yielding arsenic under these circumstances. I have found arsenic, by Reinsch's process, in the liver, after sixteen months' interment. (Case of *Reg.* v. *Southgate*, Chelmsford Lent Assizes, 1849.) The urine also contains this poison in the living and dead body.

In reference to the detection of absorbed arsenic,—as this substance is much used in skin and other diseases, its discovery does not necessarily establish the cause of death, or an act of criminal administration.

If the patient has died with arsenic in the body, there is scarcely any limit to the period at which it may be detected. In the cases of two children examined by Mr. Herapath, in July, 1849, the poison was discovered in the remains of the dead bodies after eight years' interment; and in a remarkable instance which occurred to Dr. Webster, of Boston, it was discovered in the remains of a body, after fourteen years' burial in a tomb. It has been sought for, and not found, at much shorter periods after death, where there was very strong suspicion that the poison had been taken: but it is highly probable that in these cases there was little or no arsenic in the bodies at the time of interment. The longer a person has survived, the less probable is it, *cæteris paribus*, that arsenic will be found.

In those cases where arsenic is found in a solid state after long interment, it is generally under the form of sulphuret or yellow arsenic, the white arsenic being thus changed in colour, during the process of putrefaction. This change of colour, however, is not always met with, even in bodies which have been buried for a year, or longer. (See Guy's Hosp. Reports, Oct. 1850, p. 206.) Care must be taken not to confound stains produced by bile with those caused by sulphuret of arsenic.

The medical practitioner should be aware that a crystalline substance resembling arsenic is very often produced in the dead stomach at variable periods after interment. These crystals are ammonio-phosphate of magnesia derived from putrefaction. I have met with them in several instances within the last few years. They have been mistaken for arsenic, and their occurrence has in some instances led to unjust suspicions and accusations. (See Guy's Hosp. Reports, Oct. 1850, p. 222.) An analysis will of course remove any doubt.

For many important facts connected with the quantity of absorbed arsenic deposited in the tissues, as well as the relative proportion found in different organs, and in the same organ at different periods after the taking of the poison, I must refer the reader to the valuable paper of Dr. Geoghegan, whose remarks on this subject are deserving of the highest praise.

Arsenic in the soil of cemeteries.—It appears from the researches of several toxicologists, that the soil of graveyards often contains a compound of arsenic, generally in an insoluble form. In eight trials on different soils, Orfila found three of them arsenical. He used about six pounds of earth in the experiment. As there was no sign of arsenic, except when an acid was used, he inferred that it existed in the state of arsenite or arseniate of lime. The researches of Flandin have corroborated this result; and, in one instance, this experimentalist estimated that the quantity of arsenic, in an insoluble form, in about a pound of earth, did not exceed the twentieth part of a grain! Admitting the existence of arsenic as a natural constituent of certain soils, it becomes important to determine how far it may affect the chemical evidence of the presence of this poison in the remains of bodies which have undergone exhumation. If the coffin be cracked or entirely destroyed, so that the earth has become intermixed with the remains, and that which surrounds the coffin yields traces of arsenic, it is evident that no reliance could be placed upon the inference that the arsenic existed in the human body, unless the poison found in the remains was in a soluble form and in extremely large proportion. The reader will find cases in which doubts based upon the origin of the arsenic detected in the decomposed dead body, led to the abandonment of chemical evidence. (Flandin, Traité des Poisons, 674, 683.) A difficulty of this kind cannot, however, when proper precautions are taken, often present itself in practice. A body buried in a coffin is rarely so far decomposed as to become covered by the soil from the disintegration of the coffin in a period shorter than from seven to ten years; and until such a complete disintegration has taken place, it is not easy to perceive how the presence of an *insoluble* arsenical compound, as a natural constituent of the soil, can present any objection to the results of an analysis. In the examination of these soils, it has been ascertained that no arsenical compound *soluble in water* has existed in them; therefore, if distilled water should yield, on boiling the remains, a solution of arsenic, the presumption is that it could not have been derived from the soil. It has been supposed that the arsenic may have been carried by percolation from the soil into the body; but in this case, as Flandin has observed, the exterior of the body would contain more than the interior: while in a case of arsenical poisoning (except when dependent on local application) the liver and stomach would yield more than the skin. (See Galtier, i. 368; Flandin, i. 429, 741.)

Arsenic in solids.—Arsenic may exist in solid articles of food, such as bread, pills, and powders:—in ointments, and certain candles;—or matters vomited by a person poisoned, may sometimes be imbibed by articles of clothing or furniture. In all these cases we should simply boil the solid matter, with the addition of muriatic acid and copper; or if we wish to separate the whole of the poison, we may proceed, as in the case of organic liquids, by using a current of sulphuretted hydrogen gas. A cat was poisoned by half a drachm of arsenic—the animal died in about nine hours. No trace of poison was found in the body; but a small part of the floor of the room, where the cat had vomited, was scraped off, boiled in water, and yielded on analysis clear evidence of the presence of arsenic.

Arsenite of Potash.

The compounds formed by arsenious acid in the alkalies are all poisonous. Those of potash, soda, and ammonia, are soluble in water, and, therefore, act with more energy. The Arsenite of Potash is the only preparation which here requires notice. It is used in medicine, and is well known under the name of Fowler's Mineral Solution, or Tasteless Ague Drop. It is made by boiling arsenious acid with carbonate of potash, the latter being in slight excess, and it is coloured with compound tincture of lavender. In the preparation of the London Pharmacopœia, there are four grains of arsenious acid, in a fluid-ounce (or eight fluid-drachms) of the solution. Its real strength may be affected by any impurities in the arsenious acid employed. The preparation used in Scotland is of the same strength; but that of the Dublin College is one-ninth weaker. The action of this liquid as a poison, in large doses, is in all respects analogous to that of arsenious acid.

According to Mr. Bullock, the pharmacopœial preparation is not a true arsenite of potash, but a solution of arsenious acid, in carbonate of potash, with a minute trace of the arsenite. (Lancet, Dec. 21, p. 674.) This uncertainty of composition may possibly account for the variable effects produced by the preparation. In a former page I have related the case of a female who was killed by half an ounce, in divided doses, in five days, (see ante, page 79) while Mr. Hunt, who has largely employed arsenic in the treatment of skin-disease, states that where the susceptibility is not great, a dose of *two drachms* of the solution (= *one grain* of arsenic) can be borne about as well in *one* dose as in twenty. He quotes a case in which a patient took *two drachms* of this solution, in twenty-four hours, by mistake. It cured the ague for which it was prescribed, and had no detrimental effect. (Med. Times, September 14, 1850, page 270.) It is difficult to explain such anomalies by varying susceptibility only: they are more probably due to the uncertainty of composition in the preparation employed.

The ordinary chemical processes for arsenic are sufficient for its detection in this solution.

Metallic Arsenic. Fly-Powder.

It is generally considered that metallic arsenic is not poisonous; but, as it is very easily oxidized, it speedily acquires poisonous properties. According to Berzelius, the metal is slowly converted, by exposure to air, to a pulverulent suboxide of a black or brownish-black colour. This is commonly called Fly-Powder, a name also applied to the arsenical cobalt ores reduced to powder. Thus, what is called the Tunaberg ore, a mixture of cobalt, arsenic, iron, and sulphur, is largely used on the continent under the name of Fly-Powder: and, as it comes within the reach of children, it frequently gives rise to accidents. A few years ago, Dr. Schobbens was called to a man who had taken some by mistake for a purgative. He was soon attacked with the usual symptoms of poisoning by arsenic. He swallowed a large quantity of milk, which occasioned immediate vomiting. As fifteen hours had elapsed before a medical man saw him, no treatment was of any avail, and he died from the effects of the poison. In another case, a child, aged four years, swallowed a portion of fly-powder. The hydrated sesquioxide of iron was given every half hour, and the child recovered the next day. (Monthly Jour. Med. Science, Sept. 1846, p. 228.) The exact quantity taken in these cases is not known; but there is no doubt that the poison is but little inferior to arsenious acid in activity; and the symptoms and post-mortem appearances from a fatal dose would be similar. This substance is not much known in England. A woman was convicted in France for poisoning her husband with it in 1844. (Briand, Man. Comp. de Méd. Lég. 452.) It owes its poisonous properties to arsenious acid, of which, with the metal, it appears to be a mechanical mixture.

Fly-Water is a name applied to solutions of various arsenical compounds in water. One mixture of this kind is formed by dissolving one part of the arse-

niate of soda and two parts of sugar in twenty parts of water. Paper soaked in this solution, and dried, is used for poisoning flies; and, perhaps, this is the safest form in which arsenic can be used for such a purpose.

A case of poisoning by fly-water, in which two grains and a half of arsenious acid destroyed the life of an adult in thirty-six hours, will be found reported in the Medical Gazette (vol. xxxix. page 116.)

Arsenic Acid.

This is an artificial product almost entirely confined to the chemical laboratory. Orfila states that it is a more powerful poison than arsenious acid, but he does not adduce any case in support of this opinion. Dr. Christison does not mention it, and I have not been able to find any case of poisoning by it in the human subject. Dr. Glover ascertained that four grains of the acid, dissolved in two drachms of water and introduced into the stomach of a stout rabbit, killed the animal in four hours, with the symptoms of irritant poisoning, and an affection of the nervous system. (Ed. Med. and Surg. Jour. vol. lviii. page 121.)

Analysis—Arsenic acid is a white uncrystalline deliquescent solid. 1. It is not entirely volatilized on platina foil, by the flame of a lamp. 2. It is very soluble in water, forming a highly acid solution. 3. It is precipitated of a brick-red colour by nitrate or the ammonio-nitrate of silver. In these characters it differs from arsenious acid. 4. It yields readily an arsenical sublimate with charcoal. 5. It yields deposits with copper and muriatic acid, or in Marsh's apparatus. But Dr. Rainey has shown that Reinsch's process does not act so delicately with the arsenic as with arsenious acid. The arsenic may, however, be converted to arsenious acid by a current of sulphurous acid gas. Arsenic acid is also precipitated, although slowly and of a pale yellow colour, by sulphuretted hydrogen gas. In these properties, it resembles arsenious acid.

Arseniate of Potash.

The arseniates of potash and soda must be regarded as active poisons, although there are but few instances on record, in which life has been destroyed by them. Dr. Christison states that, in the course of his reading, he has met with only two reported cases of poisoning by arseniate of potash, (Op. cit. 284.)

Sulphurets of Arsenic.

There are several kinds met with in commerce.—Orpiment or Yellow Arsenic, and Realgar or Red Arsenic. They are very poisonous in consequence of their containing a large proportion of free arsénious acid; this sometimes amounts to as much as from 30 to 70 per cent. of their weight. They are not often used as poisons. Orpiment has, however, given occasion to several criminal trials in England.

Symptoms and appearances.—The sulphurets of arsenic produce symptoms and appearances after death similar to those caused by arsenious acid; but the dose required to destroy life must vary according to the proportion of arsenious acid with which the sulphuret happens to be mixed. This is not a common form of criminal poisoning; the intense colour of the poison would lead to suspicion. It was with orpiment that Mrs. Smith was poisoned at Bristol in 1835. (Med. Quart. Rev. July, 1835, p. 390.) Its colour might cause it to be mistaken for mustard. Orpiment has been known to cause death by *external* application as a depilatory (see Annales d'Hygiène, 1834, i. 459;) a result which might be expected from the quantity of arsenious acid with which it is mixed. There is a form of depilatory used, which consists of one part of orpiment, twelve parts of quick-lime, and ten parts of starch, made into soft paste with water (Pereira, i. 218,) the use of which must be always attended with danger.

Analysis.—The powdered sulphurets yield a solution of arsenious acid on boiling them in water acidulated with muriatic acid. They readily give the well known sublimates of metallic arsenic, both with soda-flux, silver, and the hydro-

gen apparatus. They also yield a deposit of arsenic when boiled with copper and muriatic acid. Orpiment is insoluble in muriatic acid, but it is readily dissolved by caustic potash. *Organic mixtures.*—The sulphuret being insoluble in water, it is in general easily separated mechanically by allowing the matters mixed with it, to become dry upon bibulous paper. If the sulphuret cannot be separated mechanically, the organic matter suspected to contain it should be dried and boiled with nitric acid to dryness. The arsenic of the sulphuret will be found, as arsenic acid, soluble in water. Another impure sulphuret, sold as *King's yellow*, is composed, according to Dr. Christison, of sulphuret of arsenic, lime and sulphur. It is highly poisonous, and is extensively sold as a pigment. A case of alleged poisoning by this substance is reported in the Edinburgh Monthly Journal (Sept. 1846.) The sulphuret of arsenic is easily separated from the mixture by digestion in solution of ammonia.

Arsenuretted Hydrogen.

Symptoms and effects.—This is a gaseous poison of arsenic, producing, when respired in small quantity, very serious effects upon the system. It has already occasioned death in at least three instances. The gas is an artificial product, and is formed in a chemical laboratory in various ways,—one method has been already described in speaking of Marsh's process; and its highly poisonous properties render it necessary that caution should be used in the employment of this mode of testing. The gas is most effectually decomposed, and prevented from diffusing itself, by passing it into a solution of nitrate of silver. This form of gaseous arsenical poisoning has been hitherto purely accidental. Gehlen, a German chemist, was killed by accidentally breathing a small quantity. He suspected that the gas was escaping from some part of the apparatus which he was using, and applied his nose for the purpose of detecting it: although he respired but a very small quantity, he was seized in about half an hour afterwards with vomiting, shivering, and great prostration of strength. He died on the ninth day. The most complete history of this kind of poisoning has been published by Dr. O'Reilly, of Dublin. He has been kind enough to forward me the particulars of the subjoined case.

A gentleman, for the sake of experiment, wished to respire about one hundred and fifty cubic inches of hydrogen gas. It unfortunately happened that the sulphuric acid, which he used for making the hydrogen, was largely contaminated with arsenic; and immediately after respiring the gas, he was seized with giddiness and fainting, constant vomiting of a greenish-coloured matter, and dull pain in the epigastrium. There was also complete suppression of urine. He died in about six days. On dissection, the liver and kidneys were found of a deep indigo colour,—the mucous membrane of the stomach was easily separated; and there were two distinct patches of inflammation in the greater curvature. There was a quantity of reddish-coloured fluid effused in the chest, and it is an interesting fact, that Dr. O'Reilly, on examining about ten ounces of this fluid, was enabled, by the use of Marsh's process, to detect arsenic in it. From experiments made on the sulphuric acid, it is supposed that the deceased must have inhaled a quantity of arsenic equivalent to about twelve grains of arsenious acid.

Analysis.—The chemical properties of this gas have been already described. (See Marsh's Process, ante, p. 84.) [An abstract of interesting cases of poisoning by arsenic and its compounds, tried in this and other countries, will be found in Beck. (*Elem. Med. Jur.* ii. 535, to 551.) Also in Lee's edition of *Guy's Forensic Medicine*, 607. In the case of Mina, a fact given in evidence by several of the medical witnesses has not been elsewhere noticed; that when the stomach of Mr. Chapman was opened there arose a peculiar smell, resembling that of pickled herring. In reference to this, Dr. J. K. Mitchell states that a stomach which he placed in some Fowler's Solution, for two or three months, acquired the same odour. Dr. Griffith tried a similar experiment, using a solution of arsenious acid, with the same result.—H.]

CHAPTER X.

CORROSIVE SUBLIMATE—TASTE AND SOLUBILITY—SYMPTOMS—ITS EFFECTS COMPARED WITH THOSE OF ARSENIC—SLOW OR CHRONIC POISONING—SALIVATION FROM SMALL DOSES OF MERCURIAL MEDICINES—FROM OTHER CAUSES—POST-MORTEM APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—PERIOD AT WHICH DEATH TAKES PLACE—FATAL DOSE—TREATMENT—CHEMICAL ANALYSIS IN POWDER AND SOLUTION—PROCESS IN ORGANIC LIQUIDS—CALOMEL—WHITE AND RED PRECIPITATES—SULPHURETS OF MERCURY.

Corrosive Sublimate.

This substance is usually known under the chemical name of Bichloride of Mercury; but according to some distinguished authorities, it is a Chloride. To prevent any confusion from scientific chemical nomenclature, the old and popular name of Corrosive Sublimate is here used. It is not often taken as a poison. In the Coroner's report for 1837–8, there were about fifteen cases of mercurial poisoning, in twelve of which corrosive sublimate was the poison taken. It is commonly seen under the form of very heavy crystalline masses, or of a white powder.

Taste and solubility.—The *taste* of corrosive sublimate is powerfully austere and metallic, so that no poisonous quantity of it can be easily swallowed without the individual becoming immediately aware of it. It is very *soluble* in water, hot or cold, and speedily sinks in it, in which properties it differs strikingly from arsenic. I have found by experiment that one hundred grains of a cold saturated solution hold dissolved at a maximum, ten grains of corrosive sublimate; and it is stated by most chemists that two parts of boiling water (212°) will dissolve one part of the poison. It is also readily dissolved by alcohol and ether; the last body takes up one-third of its weight and has the property of abstracting it from its aqueous solution,—a principle which is sometimes resorted to for separating the poison when dissolved in organic liquids. It is soluble without change in nitric and muriatic acids, and it is a fact of some medico-legal importance, that common salt renders it more soluble in water.

Symptoms.—The symptoms produced by corrosive sublimate generally come on immediately or within a few minutes after the poison has been swallowed. In the first place, there is perceived a strong metallic taste in the mouth, often described as a coppery taste; and there is, during the act of swallowing, a sense of constriction almost amounting to suffocation, with burning heat in the throat, extending downwards to the stomach. In a few minutes violent pain is felt in the abdomen, especially in the region of the stomach, which is increased by pressure. Pain in the abdomen is, however, sometimes wholly absent. There is nausea, with frequent vomiting of long stringy masses of white mucus, mixed with blood; and this is accompanied by profuse diarrhœa. The countenance is sometimes swollen and flushed, in other cases it has been pale and anxious. The pulse is small, frequent, and irregular, becoming scarcely perceptible as the symptoms become aggravated. The tongue is white and shrivelled,—the skin is cold and clammy, the respiration difficult; and death is commonly preceded by syncope, convulsions, or general insensibility. The internal parts of the mouth, when examined, are swollen, and sometimes present the appearance as if the cavity had been washed with a solution of nitrate of silver: the lips are often swollen. Suppression of urine has also been frequently noticed among the symptoms. It existed in a well-marked case of poisoning by this substance at Guy's Hospital:—the patient lived four days, but did not pass any urine during the whole of this time. (G. H. R. April, 1844, p. 24.) This symptom was observed in an interesting case reported

by Dr. Wegeler (Casper's Wochenschrift, Jan. 10, 1846, p. 30,) in which a youth, æt. 17, swallowed three drachms of the poison, and died on the sixth day. During the last three days, no urine was secreted. This case was otherwise remarkable from the fact that no pain was experienced on pressure of the abdomen, and that the pulse underwent no change until shortly before death. In another case, reported by Dr. Herapath, in which a scruple of corrosive sublimate in solution was swallowed, suppression of urine and ptyalism came on on the third day, and the patient died on the ninth day. (Lancet, Dec. 13 and 27, 1845, pp. 650, 698.) In a case observed by Mr. Morris, the quantity of urine secreted was small, and it produced a scalding pain when voided. (Prov. Med. Jour. Nov. 18, 1843, p. 126.) In this instance there was no purging.

Its effects compared with those of arsenic.—This poison differs from arsenic: 1, in having a well marked taste; 2, in producing violent symptoms within a few minutes; and 3, in the fact of the evacuations being more frequently mixed with blood. The symptoms produced by corrosive sublimate, in the first instance, resemble those of cholera: if the individual should survive several days, they are more like those of dysentery,—tenesmus, and mucous discharges mixed with blood being very frequently observed.

Slow or chronic poisoning.—The symptoms are much modified when the poison is given in small doses at certain intervals for some days or weeks. There are colicky pains, with nausea, vomiting, general uneasiness, and depression. The salivary glands become inflamed and painful; the tongue and gums are red and swollen, sometimes ulcerated, and there is fetor of the breath. A deep blue line, like that observed in poisoning by lead, is sometimes found around the edges of the gums. The patient experiences difficulty of swallowing and breathing. The constitutional effects are indicated by cardialgia, diarrhœa, dyspnœa, hæmoptysis, cough, general tremor of the limbs, and paralysis, with slow fever and emaciation, under which the patient sinks.

Salivation.—One of the most marked effects of slow or chronic poisoning by mercurial preparations is salivation or ptyalism, indicated by an increased flow of saliva. This is by no means a necessary symptom in cases of acute poisoning by corrosive sublimate, but it not unfrequently shows itself about the second or third day. In some instances the patient dies too rapidly for this effect to follow, but even when he survives some days, salivation is not always observed. In a case related by Dr. Venables, in which two drachms of the poison had been taken, and the woman survived for the long period of eight days, this symptom did not exist. In another case reported by Mr. Wood (Ed. Med. and Surg. Jour. li. 141,) in which half a teaspoonful of the poison was taken, salivation was profuse in the course of a few hours. In a case which occurred at Guy's Hospital, in February, 1843, where two drachms had been taken, salivation commenced in four hours; but this is by no means the earliest period. Dr. Percy relates an interesting case of poisoning by corrosive sublimate, in which the saliva was flowing profusely an hour and a half after the woman had taken a dose of thirty grains. (See Med. Gaz. 1843, i. 942.) In these early cases, it is alleged that fetor of the breath is absent, but most practitioners will look chiefly to the production of salivation as a symptom. The local action of the poison is, in some of these cases, sufficient to account for the abundant flow of saliva independently of the influence of the absorbed mercury on the salivary organs. In Mr. Morris' case, in which half a drachm of the poison in powder was placed by the female on her tongue, the saliva flowed abundantly from the mouth, and the lips were much swollen. (Prov. Med. Jour. Nov. 18, 1843, p. 127.) This was undoubtedly due to the local irritant action of the poison.

In the *chronic* form of poisoning, when the dose has been small and frequently repeated, we may generally expect to meet with salivation, accompanied by fetor of the breath, and sponginess and ulceration of the gums. Should the person survive some time, this symptom is more commonly met with than not; but in

looking for it as an indication of mercurial poisoning, a medical jurist must remember that some persons are wholly unsusceptible of this condition. On the other hand, there are cases in which the salivary glands are most easily excited, so that the usual innocent doses of mercurial medicines have been known to produce salivation to such a degree as to cause death. Facts of this kind are of some importance, since charges of malapraxis may be easily raised in respect to them. Dr. Christison mentions a case in which two grains of calomel destroyed life by the severe salivation induced, as well as by ulceration of the throat. Another was mentioned to me by a pupil, in 1839, in which five grains of calomel killed an adult by producing fatal salivation. From some cases related by Mr. Samuel, of Newark, it appears that two grains of calomel, divided into three powders, were given in the proportion of one powder daily (two-thirds of a grain) to a little boy aged eight. This small dose produced the most violent salivation, sloughing, and exfoliation, from which he was some weeks in recovering. In another instance, a little girl, aged five, took daily for three days three grains of mercury and chalk powder. Her mouth was severely affected, sloughing ensued, and she died in eight days. In a third case of recent occurrence, a boy, aged eleven years, took three doses of this powder—one of six grains on the 14th, a similar dose on the 17th, and four grains on the 20th, making altogether sixteen grains. The most profuse salivation followed; sloughing commenced in both cheeks, and rapidly extended through them. The boy died in four days. Previously to the exhibition of the mercury he had recovered from an attack of fever. (Lancet, Dec. 20, 1851, p. 579.) In a fourth case, three grains of blue pill given twice a day for three days, making eighteen grains, were ordered for a girl aged nineteen, who complained of a slight pain in her abdomen. Severe salivation supervened, the teeth separated, and she died in twelve days. With respect to the effects of corrosive sublimate, Dr. Christison states that three grains of this substance in three doses caused violent salivation. (Op. cit. 408.) When this state results from the use of mild mercurial medicines in small doses, the severe effects may be in general referred to idiosyncrasy. A person may die under these circumstances, either from simple exhaustion or from extensive sloughing of the fauces, with exfoliation of the bones. When an individual has recovered from the first effects of acute poisoning by corrosive sublimate, he may die at almost any period from these secondary consequences. It is generally admitted by toxicologists that salivation may be *intermittent—i. e.* that it may cease and reappear without more mercurial poison or any mercurial preparation being given in the interim, although such cases are rare. [Although evidence is in favour of these intermittent salivations, and they certainly do sometimes appear to take place, still the fact is not so generally admitted as might be supposed from the text. Dr. Christison, who admits their *rare* occurrence, observes, on this point (323, 1st Am. ed.:) "Granting the ptyalism to be in every instance mercurial, it would require much better evidence than any practitioner could procure to determine the fact that mercury had not been given during the supposed interval."—H.]

Profuse salivation from mercury dependent on morbid causes.—In addition to the facts already detailed, respecting death from excessive salivation under the use of small doses of calomel, there are certain morbid conditions of the body which appear to have the effect of increasing the action of this medicine on the salivary glands. This kind of acquired idiosyncrasy exists especially in that form of disease called granular degeneration of the kidney, which is characterized in its early stage by albuminuria. On this subject Dr. Craige says, the great objection to the employment of any preparation of quicksilver for the cure of renal dropsy consists in the fact, that the use of the mineral is known to render the urine albuminous, to increase the inflammatory state of the system, and to induce the disease, the effects of which it is expected to remove. Another evil is, that in persons labouring under symptoms of granular kidney a very small quantity of mercury induces ptyalism, and renders the mouth tender and most

painful. (Practice of Physic, ii. 1148.) This he considers to depend much on the fact, that patients of this description have in general, if not always, been subjected previously to the full influence of the mineral in repeated courses. For these reasons, in his view, mercury should never be exhibited without the previous full trial of other remedies, as even assiduous watching will not always succeed in preventing bad effects. Dr. Christison informs me that he has repeatedly observed that mercurial action (salivation) is in these cases brought on by unusually small doses of the compounds of mercury, or unusually soon; and the action, under these circumstances, has been very violent, although not uncontrollable. [Salivation may be also caused by a variety of metallic preparations, and even by vegetable products, but in general is not accompanied by the peculiar fetor of the breath, and peculiar discoloration of the gums so constantly attendant on mercurial salivation.—H.]

Cancrum oris.—Corrosive sublimate, as well as other mercurial preparations, is liable to produce *gangrene of the mouth* and fauces,—a state which may equally occur from spontaneous causes: death is commonly the result. In a case of this kind, supposing any mercurial preparation to have been given medicinally, it may become a serious question whether death actually resulted from the mercury acting as a poison, or from natural disease. Several fatal cases have occurred within the last few years, among children; and the subject has become a matter of inquiry before coroners. Although salivation and its consequences are not common among young children, as an effect of mercurial preparations, yet it is clear, from the cases already cited (p. 96,) that small doses of mercury may have a most violent effect upon them, and render the suspicion of poisoning probable. Of two children, whose deaths became the subject of investigation under these circumstances, one was affected with whooping-cough, and the other with measles. Powders containing calomel were prescribed in both cases,—gangrene of the mouth supervened, and the children died. There was some reason to believe, from the evidence, that the mercury had really produced the effect attributed to it, at least in one of the cases. It is proper to remark, that this kind of disease, gangrene of the mouth, has been observed to occur in children to whom no calomel, or any mercurial preparation whatever, had been given:—the subjects have been chiefly young infants, badly fed and clothed, and generally labouring under, or recovering from, fever, small-pox, measles, or whooping-cough. It is, however, far more common as a consequence of measles than of other diseases, and it is always connected with a depressed state of the vital powers. Many cases of this kind are reported by Dr. Hennis Green (see Lancet, Dec. 1839.) The disease is often vulgarly called canker of the mouth.

Post-mortem appearances.—These, as in the case of arsenic, are chiefly confined to the alimentary canal. Corrosive sublimate, however, affects both the mouth and fauces; the mucous membrane is softened, of a white or bluish gray colour, and sometimes inflamed; that lining the œsophagus is similarly affected, and partially corroded and softened. The mucous membrane of the stomach is more or less inflamed, sometimes in patches; and there are masses of black extravasated blood found beneath it. Occasionally the whole cavity has a slate-gray colour from the partial decomposition of the poison by the membrane itself; beneath this, the mucous coat may be found reddened. This gray tint of the mucous membrane has been considered by some to be indicative of the action of the poison on the living mucous membrane; but it is not always present. A case occurred at Guy's Hospital, in which the mucous membrane was simply inflamed, and very much resembled the condition presented in cases of arsenical poisoning. The coats of the stomach are sometimes corroded, and so much softened that they cannot be removed from the body without laceration. Similar appearances have been met with in the small and large intestines, especially the cæcum. In a case reported by Dr. Herapath, in which a scruple was taken, and death occurred on the ninth day, the mucous membrane of the stomach was softened, but

there were no well marked appearances of the action of the poison in this organ. The cæcum had been the seat of the most violent inflammation, the whole surface being of a deep black-red colour, and there were patches of sloughing in the coats. (Lancet, Dec. 27, 1845, p. 700.) Perforation of the stomach is very rare as an effect of this poison: there is, I believe, only one case on record. Certain morbid changes have been found in the urinary and circulating organs, and Mr. Swan states that he has found the ganglia and branches of the sympathetic inflamed; but these changes are not by any means characteristic of this variety of poisoning. Appearances in the alimentary canal, like those just described, have been seen, not only where the case has terminated fatally in a few hours, but where it has been protracted for six, eight, and even eleven days. (Chaussier, Recueil des Mémoires, 363.)

Quantity required to destroy life.—This is a question which it is somewhat difficult to answer with any degree of certainty, since it is only by accident that the quantity taken can be ascertained, and the fatal effects must vary according to many circumstances. A child, aged three years, died in twenty-three days from the effects of twelve grains of corrosive sublimate. The *smallest* dose which is reported to have destroyed life was *three* grains. This was also in the case of a child, and the quantity was accurately determined from the fact of its having been made up by mistake for three grains of calomel, which the physician intended to order. (This case is referred to in the Lancet, 1845, p. 297.) A very loose and imperfect report either of the same or of a similar case is given in the Ann. d'Hyg., 1835, i. 225. It is stated that three children lost their lives. It is probable that, under favourable circumstances, from three to five grains, or even less, would destroy an adult. Persons have been known to recover who have taken very large doses, when remedies were timely administered, or vomiting was produced. I have elsewhere reported a case in which a female who had swallowed nineteen grains recovered in a few days without a bad symptom. (Guy's Hosp. Reports, Oct. 1850, p. 213.) A most interesting case of recovery after *forty grains* had been taken in whiskey under circumstances favourable to its fatal operation—*i. e.* on an empty stomach, is recorded by Dr. Andrews. (Cormack's Journal, February, 1845, 102.) The patient was a woman of sixty-five. The smallest dose required to destroy an adult, under ordinary circumstances, cannot, therefore, be determined at present from any reported facts. Judging from the effects produced by small quantities used medicinally, possibly the average fatal dose may not differ widely from that of arsenic, *i. e.* two to three grains. [A medical friend of ours has lately seen a man in this city swallow about five grains of corrosive sublimate, and was informed by the apothecary at whose shop he witnessed the act, that the individual in question was in the habit of taking the same quantity every day.—H.]

Period at which death takes place.—In an acute case, an individual commonly dies in from one to five days; but death may take place much sooner or much later than this. A person has been known to die from the effects of this poison in eleven hours (Christison, 402:) and in one instance of a child two years old, by whom twelve grains had been taken, death probably occurred in six hours. (Niemann's Taschenbuch, 451.) A case is reported in which a child, aged seven, was killed in three hours by eighteen grains of corrosive sublimate. The shortest fatal case on record was communicated to me by Mr. Welch. The quantity of poison taken was not ascertained, but the man died in less than *half an hour*. (On Poisons, p. 404.)

Chemical analysis.—In the solid state.—We will first suppose that the poison is in the *solid* state, and in the form of a white powder. 1. A small quantity heated on thin platina foil is entirely volatilized at a moderate heat—(care should be taken in performing this experiment)—in this property corrosive sublimate resembles arsenic, but differs from it in all other respects. 2. It is very soluble in water: if the water be warmed, the powder will be dissolved instantly. 3. A small

quantity of the powder dropped into a white saucer, containing a solution of iodide of potassium, is turned of a bright scarlet colour. 4. Dropped into potash in a similar way it is turned of a yellow colour. 5. Into a solution of hydrosulphuret of ammonia, it is turned black. 6. When a few grains are rubbed on a clean surface of copper, with a mixture of one part of muriatic acid, and two parts of water, a bright silvery stain is produced, which is entirely volatilized by heat. If zinc or tin-foil be used instead of copper, the surface acquires a silvery lustre, and the metal becomes remarkably brittle. 7. When mixed with three or four parts of calcined carbonate of soda, and heated in a small tube similar to that employed in the analysis of arsenic, the metal is reduced; and a ring of bright globules of mercury is formed, while common salt remains in the tube. For the success of this experiment the materials must be quite dry, and the tube at first gently heated; any undecomposed corrosive sublimate that may be sublimed should be driven higher up, before finally applying a strong heat, so that the ring of mercury may not be obscured by it. This last experiment is conclusive of the nature of the substance; because mercury, being the only liquid metal, is the only metal which sublimes in globules. If the end of the reduction-tube, containing the fused chloride of sodium, left as a residue by the decomposition, be filed off, reduced to powder, and boiled with a little diluted nitric acid, a solution is obtained in which, on the addition of nitrate of silver, chlorine may be proved to exist. The analysis is then complete. The properties mentioned under 1, 2, and 5, are possessed in common by other bodies; but the other characters are peculiar to the persalts of mercury; and when the results agree, they render it absolutely certain that the powder must be a persalt of that metal. The action of the nitrate of silver upon the solution of the residue, will prove that the persalt must have been a *chloride*. There are, therefore, no *objections* to this mode of analysis.

In solution in water.—Corrosive sublimate is very soluble in water, forming a clear solution, which, when concentrated, has a faintly acid reaction and a strong metallic taste. A few drops of the solution may be first gently evaporated on a slip of glass, and then set aside to crystallize. If it be corrosive sublimate, it forms slender opake silky prisms, sometimes of considerable length, and intersecting each other. When a weak solution of iodide of potassium is dropped on them, they acquire a bright scarlet colour, and chloride of potassium is formed. These characters, which may be obtained from the minutest crystal and only one drop of solution, prove that the body dissolved in water is corrosive sublimate: it is thus distinguished from every other mineral poison, and all other substances whatever.

Tests.—1. *Potash.* On adding a small quantity of caustic potash to the solution, a reddish-coloured precipitate falls, becoming yellow by the addition of a larger quantity of alkali. This precipitate, when washed, dried, and heated in a reduction-tube, yields a well defined ring of metallic mercury. The filtered liquid will be found, on being tested with nitrate of silver, to contain chloride of potassium, thus proving that the mercury was combined with chlorine, and that the compound was soluble in water. 2. *Protochloride of tin.*—On adding this test in rather large quantity to the solution, a white precipitate at first falls down, (calomel,) becoming speedily of a slate-gray colour, and afterwards almost black. On warming the liquid, it soon becomes clear, while a heavy precipitate, in great part formed of pure metallic mercury, falls to the bottom of the vessel. The mercury may be collected by pouring the liquid on a filter, and afterwards drying the filter; or its presence may be easily demonstrated by pouring the water carefully from the precipitate, and forcing down upon this a slip of bibulous paper;—the paper absorbs the water from the mercury, and the pressure condenses the metal into one or more well defined globules. 3. *Sulphuretted hydrogen gas.*—This gives at first a precipitate, partly black and partly white (chlorosulphuret,) becoming entirely black when the current of gas has been allowed to

pass in for some time. *Hydrosulphuret of ammonia* gives a similar precipitate in the solution;—thus clearly distinguishing corrosive sublimate from arsenic. The test acts equally in an acid solution of the salt. The precipitated black sulphuret of mercury, dried and heated with carbonate of soda or metallic silver, easily furnishes a ring of pure metallic mercury. 4. *Precipitation by metals.*—If we acidulate the liquid with a few drops of diluted muriatic acid, and introduce a slip of bright copper, or what is better, fine copper-gauze, it is soon coated with metallic mercury, having more or less of a silvery lustre, especially on friction. On heating the copper in a reduction-tube, the mercury may be obtained in well defined globules. 5. *The galvanic test.*—There are various ways in which galvanism may be applied to the detection of mercury in corrosive sublimate. Dr. Wollaston, on one occasion, employed an iron key and a guinea: he placed a drop of the suspected solution on a surface of gold, and touched it and the gold with the key:—the mercury was deposited on the gold in a bright silvery stain. The following is a ready method of producing the metal:—Place a few drops of the solution on a clean surface of copper and slightly acidulate it with muriatic acid; then touch the copper through the solution with a slip of zinc-foil. Wherever the copper is touched by the zinc the mercury is deposited, and on washing the surface with diluted muriatic acid or ammonia a silvery stain is left, which is immediately dissipated by the heat of a spirit-lamp. The experiment may be modified by twisting a slip of zinc round a slip of bright copper, or copper-gauze, and introducing them into the liquid;—any change of colour or tarnish is very apparent on the copper. Mercury is deposited on both metals. A surface of gold with zinc is, perhaps, more delicate than a surface of copper as a test of the presence of mercury. Applied in a way to be presently explained, it will detect the metal when nearly every other method fails. Other tests have been proposed; but I omit all notice of them, because the foregoing are, in my opinion, quite sufficient for every practical purpose. [Value of these tests, according to Devergie:—Potash 7000; Proto-chloride of tin, 80,000; Sulph-hyd. 60,000; galvanic test, 80,000.]

In liquids containing organic matter.—The same process of analysis will apply to the *vomited matters* and *contents of the stomach*. Masses of corrosive sublimate may be sometimes locked up in thick viscid mucus; and in such cases, the coarse powder, being heavy, may be sometimes separated by simply agitating the viscid liquid in water, and then decanting it suddenly. This poison is decomposed and precipitated by many organic principles, such as albumen, fibrin, mucous membrane,—also by gluten, tannic acid, and other vegetable substances. Thus, then, we cannot always expect to find it in a state of solution. We must filter in order to separate the liquid from the solid portion; and our first object will be to determine whether any of the poison is held in solution. For this purpose a portion of it may be shaken with one-third of its volume of ether, and after a time the ethereal liquid decanted and allowed to evaporate spontaneously in a watch-glass, or other convenient glass vessel. If corrosive sublimate be present in large quantity, white prismatic crystals will appear, which are rendered scarlet when touched with a solution of iodide of potassium. The other properties of the poison may also be brought out by dissolving the crystalline residue in water, filtering the solution through a wet filter, and applying the appropriate tests. The quantity of corrosive sublimate may be too small for this method of separation; then we may acidulate the liquid with about one-tenth part of its volume of muriatic acid, and introduce a slip of copper-gauze, at the same time warming the liquid. If the poison be present, even in minute quantity, the gauze speedily acquires a silvery gray colour, from a deposit of mercury. It should be well washed in water, in alcohol or ether, again in water, and then dried. On heating it in a reduction tube, a ring of fine metallic *globules* will appear in a detached form, and having a silvery white lustre. There is no angularity, transparency, or crystalline character about this sublimate, as in the case of arsenic—a fact speedily made evident under the microscope.

In order to remove any doubt, the ring of glass on which the sublimate is deposited may be broken up and warmed in a wide tube with a few drops of nitro-muriatic acid. On evaporating to dryness at a very low temperature (corrosive sublimate being volatile,) a residue having a prismatic crystalline character remains. These are crystals of corrosive sublimate re-formed from the globules of metallic mercury. When touched with a solution of iodide of potassium, they acquire a scarlet colour. In very fine sublimates this, or some corroborative experiments on their nature, are indispensably necessary.

The galvanic *gold test* may be thus applied:—Cut a slip of fine gold-foil, of about one inch in length and one-eighth of an inch in width; it should be just large enough to enter into a small reduction-tube. We then twist round this, in a spiral form, a slip of finely laminated zinc; acidulate the suspected liquid with a few drops of diluted muriatic acid, and suspend the gold and zinc by a thread in the midst of it. Several such pieces may be at once suspended in the liquid. According to the quantity of mercury present, the gold will be coated with a gray-coloured deposit, either immediately or in the course of a few hours. If at the end of ten or twelve hours the gold retain its bright yellow colour, there is probably no mercury present in a dissolved form, or the quantity is exceedingly minute. Supposing the gold to have lost its colour, owing to its having become completely coated, we should remove it and dip it in ether, and afterwards in distilled water, to wash off any corrosive sublimate and organic matter adhering to it: it should then be dried in air without being allowed to touch any surface, and introduced into a reduction-tube. The zinc may be in part dissolved; but as mercury is also deposited on this metal, whereby it is commonly rendered quite brittle, it may be introduced with the gold into the tube. On applying heat, a fine sublimate will soon appear in the cool part of the tube, which, if not perceptible to the eye, may be easily seen, by the aid of a common lens, to consist of minute globules of mercury. Fine wires of gold and zinc may be substituted for the foil.

Let us suppose that the filtered liquid contains no trace of a mercurial salt; we must now direct our attention to the analysis of the *insoluble matters* separated by filtration. These may be boiled in distilled water; the liquor filtered and tried by agitating it with one-third of its volume of ether. It will be found, when the analysis has not been long delayed, that most of the compounds which corrosive sublimate forms with organic matter, yield commonly sufficient poison for detection by boiling them in water. Should water fail in extracting the poison, the substance may be brought to dryness and heated with nitromuriatic acid until all the organic matter is decomposed, and the surplus acid expelled. The residue may then be digested in water and tested for mercury by the aid of copper-gauze or of gold and zinc. I have separated mercury from the liver by simply boiling it with muriatic acid, as in Reinsch's process for arsenic, and plunging into the liquid slips of copper-gauze.

A person may die from the effects of corrosive sublimate, and no mercury may be found in the tissues. A case of this kind occurred to me some years since at Guy's Hospital; and another, in which the deceased died in fifteen days from a large dose of corrosive sublimate in whiskey, has been reported by Dr. Geoghegan. On this occasion, although the local effects of the poison on the throat, stomach, and bowels were of an intense kind, the viscera, on careful analysis, yielded no trace of mercury: it had been entirely eliminated. (See Med. Gaz. vol. xlvi. p. 253.)

CALOMEL.

This substance, now called chloride of mercury, although commonly regarded as a mild medicine, is capable of destroying life, even in comparatively small doses. Several cases have been already referred to, where excessive salivation, gangrene of the salivary organs, and death, have followed from the medicinal

dose of a few grains. There is a case reported in the Med. Gaz. (xviii. 484,) in which a boy, aged fourteen, was killed in about three weeks by a dose of only six *grains* of calomel. It is singular that in this case neither the teeth nor the salivary glands were affected; still, considering the effects of calomel in other instances, it seems most probable that the ulceration and gangrene of the face which followed were due to it. Pereira mentions the case of a lady who was killed by a dose of twenty grains of calomel: she had previously taken a moderate dose without a sufficient effect being produced. Sobernheim states that a girl, aged eleven, took in twenty-four hours eight grains of calomel, for an attack of croup, and died in eight days from inflammation and ulceration of the mouth and fauces. In another instance, which occurred to Lesser, fifteen grains of calomel produced similar effects, with excessive salivation; and this patient also died in eight days. Meckel relates that twelve grains have destroyed life. (Lehrbuch der Ger. Med. 267.) Two cases of death from calomel, in children, are recorded in the Registration returns for 1840.

There are many other fatal cases on record, and the facts seem to leave no doubt that calomel may, in large doses, act as an irritant poison. It was supposed that these effects might be ascribed to this compound being adulterated with corrosive sublimate; but this supposition is not well founded. It has been further supposed that calomel might be converted into corrosive sublimate, by the free muriatic acid contained in the gastric secretions; but the very minute proportion in which this acid exists in the gastric juice, according to Dr. Prout, renders this explanation improbable.

White Precipitate. Ammonio-Chloride of Mercury.

This is an irritant compound, although little is known concerning its effects. In January, 1840, a young woman who had swallowed this substance was received into St. Thomas's Hospital. She had mixed it and taken it in water,—but the quantity swallowed could not be ascertained. The stomach-pump was employed, mucilaginous drinks and olive oil were administered; and in the course of a few days she perfectly recovered. The symptoms under which she suffered were those of gastric-irritation. Judging from this case, white precipitate does not appear to be a very active preparation; yet still it must be regarded as a poison. One instance of death from salivation produced by this compound is recorded in the Registration returns for 1840, in a child, aged seven; and within the last two years there have been several attempts at murder by the administration of this substance. It is much used by the poor as a popular external remedy for the ringworm.

Red Precipitate. Red Oxide of Mercury.

This substance is poisonous, but instances of poisoning by it are very rare. The following case occurred at Guy's Hospital in 1833. A woman aged twenty-two, who had swallowed a quantity of red precipitate, was brought in, labouring under the following symptoms:—The surface was cold and clammy, there was stupor approaching to narcotism,—frothy discharge from the mouth, and occasional vomiting:—the vomited matters contained some red powder, which was proved to be red precipitate. There was considerable pain in the abdomen, increased by pressure; and there were cramps in the lower extremities. On the following day the fauces and mouth became painful, and the woman complained of a coppery taste. The treatment consisted in the use of the stomach-pump, and the free administration of albumen with gluten. She left the hospital four days afterwards, still under the influence of mercury. The quantity of oxide here taken was not ascertained. Sobernheim relates a case where a man, aged twenty-six, swallowed an ounce of red precipitate. He was speedily attacked with pain in the abdomen, nausea, purging, cramps, and general weakness. The vomited matters consisted of masses of mucus containing red precipitate. He

continued to get worse, and died in less than forty-eight hours after taking the poison. On inspection the mucous membrane was found eroded and inflamed in patches, small particles of the poison being imbedded in it. The duodenum was in a similar state, and there was a large quantity of red precipitate in the contents of this viscus, as well as in the stomach. (Op. cit. 250.) [Alison relates a case in which a woman swallowed about thirty-five grains:—an emetic was immediately given, and the stomach-pump was used. A burning pain continued for some time after the evacuation of the stomach, but was relieved by bleeding, and the patient gradually recovered. (Lancet N. S. 19, 401.)—H.]

A common opinion exists among the vulgar, that this compound is possessed of very active poisonous properties; hence it is sometimes administered with criminal design.

Cinnabar. Vermilion. Persulphuret of Mercury.

The term *Cinnabar* is applied to a dark and heavy compound of sulphur and mercury, while *Vermilion* is the same substance reduced to a fine powder. It is well known as a red pigment, and is often employed in colouring confectionary, wafers, &c. I have not been able to find any instance of its having acted as a poison on man. Orfila believes that it is not poisonous. It has, however, proved fatal to animals in the proportion of from thirty to seventy grains, even when applied externally to a wound. Cinnabar is sometimes used for giving a red colour to ointments, *e. g.* the sulphur ointment. In such cases the quantity is very small, and can do no injury even if swallowed.

Dr. Sutro has published a short abstract of a case in which the *vapour of Vermilion* applied externally produced severe symptoms. A woman, by the advice of a quack, applied this vapour to a cancerous breast. She employed three drachms of vermilion, covering herself with a sheet so that the vapour should only reach the body externally. After three fumigations, she suffered from severe salivation and violent fever, which continued for four weeks. The right arm became œdematous. (Med. Times, Sept. 27, 1845, p. 17.) ["A patient in the surgical ward of the Louisville Hospital, labouring under a venereal ulcer of the palate, was directed to use mercurial fumigations, which he did in the manner and to the degree usually practised in the ward; but it proved fatal to him in less than half an hour." (Beck, ii. 596, from West. Jour. of Med. & Surg., 1840, 84.)—H.]

Bicyanide of Mercury.

This is a substance which is but very little known, except to chemists, yet it is an active poison, and has caused death in one instance. In April, 1823, a person who had swallowed twenty grains of this compound (thirteen decigrammes) was immediately seized with all the symptoms of poisoning by corrosive sublimate, and died in nine days. There was continued vomiting, with excessive salivation, ulceration of the mouth and fauces, suppression of urine, purging, and lastly, convulsions of the extremities. On inspection, the mucous membrane of the stomach and intestinal canal was extensively inflamed. (Orfila, i. 583.) Dr. Christison quotes a case in which ten grains destroyed life within the same period of time. (On Poisons, p. 427.) As a poison, the bicyanide is probably not much inferior in activity to the bichloride of mercury.

Turbith Mineral. Subsulphate of Peroxide of Mercury.

Fatal cases of poisoning by this compound are by no means common. It is undoubtedly, although very insoluble, a strong irritant poison, and is capable of causing death in a comparatively small dose. A well marked instance of its fatal operation was communicated to the Pathological Society by Mr. Ward, in March, 1847. A boy, æt. 16, swallowed *one drachm* of this preparation on the night of February 19th. It produced a burning sensation in the mouth and throat, and

vomiting in ten minutes. In about an hour there was paleness with anxiety of countenance, coldness of surface, constant sickness, sense of heat and constriction in the throat, and burning pain in the stomach with cramps. The irritability of the stomach continued in spite of treatment, and after two days there was salivation with mercurial fetor. The gums acquired a deep bluish tint and began to ulcerate. The patient died in about a week after he had taken the poison, without convulsions, and without suffering at any period from symptoms of cerebral disturbance. The principal post-mortem appearances were—inflammation of the œsophagus, its mucous membrane at the lower part peeling off; the inner surface of the stomach near the cardia and pylorus was covered with petechial spots; the small intestines were contracted, the inner coat reddened, and petechial spots were found, but chiefly in the large intestines. The parotid and submaxillary glands were swollen. Mercury was detected in the intestines. (See Med. Gaz. xxxix. 474.) From this account it will be perceived that turbith mineral has an action somewhat similar to corrosive sublimate, although it is certainly much less active.

Nitrates of Mercury.

These are corrosive poisons which are used for several purposes in the arts. They are solid white salts, easily dissolved by water, especially if there be a little excess of acid present. The acid pernitrate has already caused death in an interesting case reported by Mr. Bigsley in the Medical Gazette (vi. 329.) A butcher's boy dissolved some mercury in strong nitric acid, and swallowed about a teaspoonful of the solution. Soon afterwards he suffered the most excruciating pain in the pharynx, œsophagus, and stomach:—there was great anxiety, with cold skin, small pulse, colic, and purging. He became gradually weaker, and died in about two hours and a half. On inspection, the fauces, œsophagus, and stomach were found corroded and inflamed. Although he survived so short a time, the mucous membrane of the stomach was of a deep red colour. I have elsewhere related a singular case in which the application of the pernitrate of mercury to the throat as an escharotic caused immediate death by asphyxia. (See Guy's Hosp. Reports, Oct. 1850, 206.)

The acid nitrate of mercury has often been employed by accoucheurs as a local application in diseases of the neck of the uterus. In one instance in which it was thus used, the ordinary symptoms of mercurial poisoning showed themselves, and the patient appears to have suffered severely. (Med. Gaz. vol. xlv. p. 1025.)

CHAPTER XI.

ON POISONING BY LEAD—SUGAR OF LEAD—SYMPTOMS—CHRONIC POISONING BY SUGAR OF LEAD—POST-MORTEM APPEARANCES—TREATMENT—QUANTITY REQUIRED TO DESTROY LIFE—CHEMICAL ANALYSIS—LEAD IN ORGANIC MIXTURES—CARBONATE OR WHITE LEAD—PAINTER'S COLIC—OXIDES—LITHARGE AND RED LEAD—ACCIDENTS FROM THE GLAZING OF POTTERY.

Sugar of Lead. Acetate.

This is more frequently taken as a poison than any of the other salts, although cases of acute poisoning by lead in any form are very uncommon. In the Coroner's report for 1837-8 there is not a single instance. The substance is commonly met with in solid heavy crystalline masses, white, or of a brownish-white colour: it much resembles loaf-sugar in appearance, and has often been

mistaken for it. It has also a sweet taste, which is succeeded by an astringent or metallic taste. It is very soluble in water. Four parts of water at 60° will dissolve one part; and it is much more soluble at a boiling temperature.

Symptoms.—Acetate of lead is by no means an active poison, although it is popularly considered to possess a very virulent action. In medical practice it has often been given in considerable doses without any serious effects resulting. Dr. Christison states that he has given it in divided doses to the amount of eighteen grains daily for eight or ten days without remarking any unpleasant symptom whatever, except once or twice slight colic. (Op. cit. 555.) When, however, the quantity taken has been from one to two ounces, the following symptoms have been observed:—A burning pricking sensation in the throat, with dryness and thirst:—vomiting supervenes; there is uneasiness in the epigastrium, which is sometimes followed by violent colic. The abdomen is tense, and the parietes have been occasionally drawn in. The pain is relieved by pressure, and has intermissions. There is in general constipation of the bowels. If any fæces be passed, they are commonly of a very dark colour, indicative of the conversion of lead to sulphuret. The skin is cold, and there is great prostration of strength. When the case is protracted, the patient has been observed to suffer from cramp in the calves of the legs, pain in the insides of the thighs, numbness and sometimes paralysis of the extremities. The affection of the nervous system is otherwise indicated by giddiness, torpor, and even coma. A well marked blue line has been observed round the margin of the gums, where they join the teeth.

Since the publication of the former edition of this work, a remarkable series of cases of poisoning by acetate of lead has been reported by Mr. Bancks, of Stourbridge. (Lancet, May 5, 1849, p. 478.) By some accident, about thirty pounds of this substance were mixed at a miller's with eighty sacks of flour, and the whole was made into bread by the bakers and supplied as usual to their customers. It seems that no fewer than five hundred persons were attacked with symptoms of poisoning after partaking of this bread. In a few days they complained of a sense of constriction in the throat and the pit of the stomach, violent crampy pains round the navel, rigidity of the abdominal muscles, a dragging pain in the loins, and cramp, with paralysis of the lower extremities. There was obstinate constipation, and the urine was scanty and of a deep red colour. The pulse generally was slow and feeble; the countenance anxious and sunken, frequently of a peculiar livid hue; tongue flabby; gums marked by a deep blue line. The surface was cool, and there was a general arrest of the secretions. Sickness was not a uniform symptom, and even when it existed at first, it speedily subsided. The mental faculties were undisturbed. Not one of the cases proved fatal, but among the more aggravated there was great prostration, with collapse, livid countenance, universal cramps, numbness, and other alarming symptoms. After apparent convalescence, some of the symptoms returned in a more aggravated form without any obvious cause, and for a long time the patients were out of health. Inflammation was not observed. Purgative medicines were found most effectual in the treatment. The quantity of acetate of lead taken by each person could not be determined, as, on analysis, the samples were found to be very unequally impregnated with the poison. [See Beck, ii. 659, for an analogous instance in which near one hundred persons were almost simultaneously affected with lead colic, three fatally, and several seriously, many also suffering paralytic symptoms. These effects were traced to the use of sugar obtained from a particular mercantile establishment, and imported from Barbadoes. Chemical investigation demonstrated the presence of lead, which was supposed to have been derived from leaden reservoirs employed in reducing the syrup from which the sugar was made.—H.]

Even when the patient recovers from the first symptoms, the secondary effects often last for a considerable time. In two cases which occurred to Mr. Gorringe, two girls swallowed an ounce of the acetate of lead by mistake. Soon afterwards

they felt a burning pain in the mouth, throat, and stomach, and in a quarter of an hour they vomited freely: in half an hour there was severe pain in the bowels, with diarrhœa. Under treatment recovery took place. (Prov. Med. Journ. April, 1846.) Although nearly a year had elapsed, they both suffered from severe pain in the epigastrium, which was tender on pressure. Nothing could be retained on the stomach; and there was a choking sensation in the throat, with other constitutional symptoms. Paralysis and other symptoms of nervous disorder, are, however, by no means necessary consequences. A girl who had swallowed sixty grains of acetate of lead, and suffered severely from the primary symptoms, recovered, and left the hospital in about three weeks without any paralysis or other disorder affecting the muscular system. (Lancet, April 4, 1846, p. 384.) This lead-palsy appears to be a more common consequence of small doses frequently repeated.

Post-mortem appearances.—In one acute case related by Dr. Kerchhoffs, the mucous membrane of the stomach was found abraded in several places, especially near the pylorus; and most of the abdominal viscera were in a state of high inflammation. A trial for murder by this substance took place at the Central Criminal Court, in November, 1844, (*Reg.* v. *Edwards*,) but the details are so imperfectly reported as to throw no light upon the subject. The stomach and intestines are stated to have been found inflamed, and there were dark spots on the former. In animals, according to Dr. Mitscherlich, when the dose is large, the mucous coat of the stomach is attacked and corroded: this change appears to be purely chemical, and takes place in all the organs of the body with which the salt of lead comes in contact. If given in a small dose, it is decomposed by the gastric secretions, and exerts no corrosive power on the mucous membrane. When the acetate of lead was given in a state of albuminate dissolved by acetic acid, death took place with great rapidity; but on inspection, the stomach was not found to be corroded. This corrosive action belongs to the neutral salt, and is not manifested when the dose is small, or when the poison is combined with an acid.

Quantity required to destroy life.—Nothing is accurately known concerning the *fatal dose* of sugar of lead. The facts already detailed show that it may be taken in comparatively large quantities without producing serious effects. Thirty and forty grains have been given daily, in divided doses, without injury. The following additional cases, in some of which recovery took place under very disadvantageous circumstances, prove that the acetate of lead is far from being a virulent poison:—Dr. Iliff met with an instance where *an ounce* was swallowed in solution. The symptoms were pains in the abdomen resembling colic, vomiting, rigidity, and numbness. It was three hours before any remedies were used, and five hours before the stomach-pump was employed; but the person recovered. In the second case, also, an ounce was swallowed: sulphate of magnesia was freely exhibited, and the stomach-pump was used. On the following morning there was slight excoriation of the gums, which were white, with a sensation of heat in the throat: the bowels were relaxed, probably from the effect of the medicine. The day following there were pains in the calves of the legs and thighs, with restlessness and thirst. In a week the woman perfectly recovered.

Chemical analysis. Acetate of lead as a solid.—1. If a portion of the powder be heated in a small reduction tube, it melts, then becomes solid; again melts, acquiring a dark colour, and gives off vapours of acetic acid; a black mass is left in the tube, consisting of carbon and reduced metallic lead. There is no sublimate formed. 2. It is very soluble in water, even when cold; common water is turned milky by it, from the presence of carbonic acid and sulphates. 3. A small portion of the powder dropped into a saucer, containing a solution of iodide of potassium, acquires a fine yellow colour. 4. When dropped into caustic potash, it remains white;—5. Into hydro-sulphuret of ammonia, it is turned black, in which respect it resembles the white salts of some other metals. 6. When the

powder is boiled in a tube with diluted sulphuric acid, acetic acid, known by its odour and volatility, escapes. All these properties, taken together, prove that the salt is acetate of lead.

Acetate of lead in solution.—If acetate of lead be presented in a state of solution, or if the solid salt be dissolved in water for the purpose of making further examination, we should note the following points. 1. A small quantity, slowly evaporated on a slip of glass, will give white and opake prismatic crystals, which are turned yellow by iodide of potassium, and black by hydro-sulphuret of ammonia. The solution is said to be neutral; but I have found the common acetate of lead to have at the same time both an acid and an alkaline re-action, *i. e.* reddening litmus-paper, and turning rose-paper green, a circumstance which might create some embarrassment in an analysis. 2. *Caustic potash*, added to the solution much diluted with water, throws down a white precipitate, which is easily soluble in an excess of the alkali. 3. *Diluted sulphuric acid* produces an abundant white precipitate, insoluble in nitric acid, but soluble in muriatic acid and in a large excess of caustic potash. 4. It is precipitated of a bright yellow colour by the *Iodide of potassium;* the yellow iodide of lead is soluble in caustic potash, forming a colourless solution. It is also dissolved by concentrated muriatic acid. 5. *Hydrosulphuret of ammonia*, or sulphuretted hydrogen gas, produces a deep black precipitate, even when less than the 100,000th part of the salt is dissolved. 6. Place a few drops of the solution on clean platina-foil,—acidulate it with acetic acid, then apply, through the solution, to the surface of the platina, a thin polished slip of zinc:—bright crystals of metallic lead are instantly deposited on the zinc: in this way a small quantity of lead may be detected.

Lead in organic mixtures.—The acetate of lead is precipitated by many organic principles, especially by albumen and tannin. Thus, we may have to analyze either an organic liquid containing lead, or a solid precipitate consisting of mucous membrane, intimately united to oxide of lead. The liquid must be filtered and examined by a trial test, *i. e.* either by adding to a portion sulphuric acid, or by exposing bibulous paper dipped into the suspected liquid, to a free current of sulphuretted hydrogen gas. If the paper be not stained brown, there is no perceptible quantity of lead dissolved;—if it be stained brown, we dilute the liquid if necessary in order to destroy its viscidity, and pass into it a current of sulphuretted hydrogen until all action has ceased. The black sulphuret of lead should be collected on a filter, washed and dried, then boiled for a quarter of an hour in a mixture of one part of nitric acid, diluted with four parts of water. This has the effect of transforming it, at least in part, to nitrate of lead soluble in water. This liquid, when filtered, may be evaporated to dryness, and the residue dissolved in water, or it may be at once cautiously neutralized by potash or ammonia (free from lead) and the tests added. If the quantity be too small for the application of all the tests, we may add sulphuric acid; should a white precipitate be formed, soluble in potash, and this alkaline solution be again turned black by hydro-sulphuret of ammonia, this is sufficient evidence of the presence of lead. Should there be no lead dissolved, we must decompose the solid and insoluble matters in nitric acid slightly diluted, at a boiling temperature, filter, and test the filtered liquid, previously neutralized; or we may evaporate to dryness, destroy the organic matter by nitric acid, and redissolve the residue in water for testing.

Goulard's Extract. Subacetate of Lead.

Symptoms and Effects.—This substance has caused death in at least four instances,—one in France and three in England. The symptoms produced are similar to those described in speaking of the former compound.

Goulard Water is nothing more than a mixture of one drachm and a half of this solution to a pint of water.

Carbonate of Lead.

Symptoms.—A very interesting case of poisoning by the carbonate of lead was reported, in October, 1844, to the Westminster Medical Society, by Dr. Snow. A child aged five years ate a portion not so large as a marble, ground up with oil. For three days he merely suffered from pain in the abdomen and costiveness. On the third night, the child became rapidly worse, and there was vomiting. He died ninety hours after taking the poison, having passed some very offensive motions of a greenish-black colour (probably from sulphuret of lead) before he died. The mucous membrane of the stomach was much inflamed, and of a dark-red colour throughout. Poison could not be detected in the contents or tissues of the stomach or in the matter vomited. It is remarkable that in this case so small a quantity should have proved fatal without exciting any marked symptoms of irritation in the first instance. There are many fatal cases of poisoning by the carbonate of lead in the human subject, but it has in these instances proved insidiously fatal by inducing *Colica pictonum*. They are to be regarded as cases of chronic poisoning.

Colica Pictonum.—Painter's Colic may be considered to be a *chronic* form of poisoning by carbonate of lead, indicated by violent pain in the bowels, constipation, and paralysis. Among white lead manufacturers, the carbonate finds its way into the system, either through the skin or through the lungs, or both together;—it becomes diffused in a fine powder through the atmosphere, and thus enters into the lungs. It has been remarked in France, that in manufactories, where the powder was ground dry, not only have the labourers suffered, but also horses, dogs, and even rats, have died from its effects. Since the practice has arisen of grinding the carbonate in water, cases of colica pictonum have not been so numerous.

Symptoms.—The diagnostic symptoms of chronic poisoning by lead are well marked. There is first pain, with a sense of sinking commonly in or about the region of the umbilicus. Next to pain there is obstinate constipation, retraction of the abdominal parietes, loss of appetite, thirst, fetid odour of the breath, and general emaciation. The skin acquires a yellowish or earthy colour, and the patient experiences a saccharine, styptic, or astringent taste in the mouth. A symptom of a peculiar nature has been pointed out by Dr. Burton and others (Med. Gaz. xxv. 687,) namely, a *blueness* of the edges of the *gums*, where these join the bodies of the teeth: the teeth are of a brownish colour. Dr. Chowne states that from inquiry and observation, he considers that the presence or absence of this blue line is not connected with the administration or non-administration of lead. (Lancet, Oct. 26, 1844.) It has, however, been so frequently observed, that most pathologists now regard it as a well marked pathognomonic symptom. A similar blue mark around the edges of the gums has been noticed in other cases of poisoning—as by mercurial preparations (ante, p. 95;) and it is possible that in an advanced stage of chronic poisoning by lead it may be absent, (see a case by Mr. Fletcher, Med. Times, Feb. 14, 1846, p. 395:)—as where, for example, the individual has ceased to expose himself to emanations of lead. Many facts tend to show that it is an early symptom. This disease often kills the patient; and after death the large and small intestines are found contracted, —especially the colon.

For a remarkably interesting series of cases of chronic poisoning by lead, I must refer the reader to a paper, by Dr. de Mussy, published in the Dublin Quarterly Journal, for May, 1849; also Medical Gazette, vol. xliv. page 260. These cases occurred at Claremont, in the members of the Royal Family of France. The effects were traced to the use of very pure water, which had acquired an impregnation of lead from contact with that metal, in the proportion of one grain to the imperial gallon. Thirteen out of thirty-eight persons were affected, and to such a degree, that the nails of the toes and fingers so-

quired a bluish discoloration. The children of the family did not suffer. [For two very interesting papers on lead poisoning from spring and cistern water, beer, gin, rum, mineral water, &c. &c., see Fenner's Southern Med. Rep. i. 182—189, and ii. 247—280.—H.]

Analysis.—Carbonate of lead is a solid white powder, insoluble in water, and immediately blackened by sulphuretted hydrogen or hydro-sulphuret of ammonia. 1. When heated on platina, it leaves a residue of yellow or orange-coloured oxide of lead, soluble in nitric acid. 2. The carbonate is easily dissolved, with effervescence, by diluted nitric acid—a fact which shows that it contains carbonic acid. The oxide of lead, combined with nitric acid, may be readily detected by the tests already mentioned. This salt of lead is sometimes contained in very small proportions in loaf-sugar, owing to the moulds in which the loaf is set to crystallize being painted with white lead, and a portion being thus mechanically taken up. This is a dangerous process, and ought to be prohibited.

Oxides of Lead.

The yellow oxide (massicot,) and the brown oxide (peroxide,) are but little known except to chemists. *Litharge* and minium or *Red lead* are, however, much employed in the arts, and have sometimes given rise to accidental poisoning. In October, 1849, a woman who had swallowed two and a quarter ounces of the red oxide of lead, was admitted into Guy's Hospital. No symptoms appeared for nine hours. There was then colicky pain with urgent vomiting, followed by headache and general tenderness of the abdomen. She entirely recovered in about twelve days (Guy's Hosp. Reports, October, 1850, 209.)

Liquids used for culinary or dietetic purposes, especially if they contain a free *acid*, are liable to become sometimes impregnated with oxide of lead, derived from the glaze of the vessel in which they are kept, and to form poisonous salts. If vinegar be used, acetate of lead may result. Litharge-glaze is also easily dissolved by alkaline or *fatty* substances. The eating of dripping, or the fat of meat, baked in a newly glazed vessel, has been thus known to give rise to slight attacks of colic; while the symptoms were referred by the party to some substance mixed with the food. A case in which the whole of the members of a family were thus poisoned, will be found in the Lancet (July 4, 1846, p. 27.) Another case of a similar kind will be found reported in the Medical Gazette (vol. xlvii. page 659.) When articles of this kind are impregnated with oxide of lead, the fact is immediately known by their being turned of a brown colour by hydrosulphuret of ammonia. All newly glazed vessels yield traces of lead, more or less, on boiling in them acetic acid or caustic potash. In this way, the poisonous nature of the glaze may be tested,—the oxide of lead being dissolved by the acid or the alkali. Litharge was formerly much used to remove the acidity of sour wine, and to convey a sweet taste. Acetate of lead, or some other vegetable salt of the metal, is in these cases formed; and the use of such wine may be productive of alarming symptoms. Many years since, a fatal epidemic colic prevailed in Paris owing to this cause:—the adulteration was discovered by Fourcroy, and it was immediately suppressed. Such wine is known by its being blackened by hydrosulphuret of ammonia. [More recently a similar prevalence of this disease in Paris was produced by the use of cider similarly poisoned. (Bull. de Thérap. xlii. 122, from Brit. For. Rev. x. 262.) An interesting instance of slow lead poisoning at sea, on a voyage from Calcutta, owing to the use of claret wine that had been sophisticated with litharge, was related to us by one of the sufferers. He was a cabin passenger, and only escaped with his life by leaving the vessel before the voyage was completed. The master of the ship and one of his officers were fatally diseased before the source of the mischief was discovered.—H.] Snuff has been adulterated with red lead: in one instance this mixture is supposed to have caused death, and in another, it gave rise to serious symptoms. (Med. Gaz. xxxii. 138; also Ann. d'Hyg. 1831, ii. 197.)

CHAPTER XII.

COPPER—BLUE VITRIOL. SYMPTOMS. POST-MORTEM APPEARANCES—TREATMENT. POISONING BY VERDIGRIS—SUBCHLORIDE OF COPPER—CARBONATE—SCHEELE'S GREEN. CHEMICAL ANALYSIS—TESTS—SPECIAL CHARACTERS OF THE SALTS. COPPER IN ORGANIC LIQUIDS—IN ARTICLES OF FOOD.

ALL the salts of copper are poisonous. The two most commonly known are the SULPHATE OR BLUE VITRIOL, and the SUBACETATE OR VERDIGRIS. These substances have been frequently taken and administered in large doses for the purposes of suicide and in attempts at murder. In the latter case the attempt has been immediately discovered, owing to the very strong metallic taste possessed by the salt. This would in general render it impossible that the poison should be taken unknowingly. With the exception of these salts, poisoning by copper is usually the accidental result of the common employment of this metal for culinary purposes.

SULPHATE OF COPPER.

Symptoms.—Sulphate of copper has been frequently given for the purpose of procuring abortion. In doses of half an ounce and upwards, it acts as a powerful irritant on adults, and a much smaller quantity would suffice to destroy infants or children. The salt speedily induces vomiting of the most violent kind: this sometimes expels the poison from the stomach, and the person recovers. The *vomited* matters are remarkable for being generally of a *blue* or *green* colour; and broken crystals of blue vitriol have been discovered in them, when the poison was taken in a loosely pulverulent state. If the green colour of the vomited liquids be owing to altered bile, it will not acquire a blue tint on adding to a portion of the liquid a strong solution of ammonia; but if it be caused by a salt of copper, this change of colour will serve to indicate the fact. There is headache, pain in the abdomen, with diarrhœa; the pain is of a colicky character; and in aggravated cases there are spasms of the extremities, and convulsions. Dr. Percival met with a case where the most violent convulsions were produced in a young female by two drachms of the sulphate of copper. Paralysis, insensibility, and even tetanus, have preceded death, when the poison was administered to animals. Among the symptoms casually met with in the human subject, may be mentioned jaundice. This has been observed to attend poisoning by the sulphate, as well as by Scheele's green. The medicinal dose of sulphate of copper as an emetic, is from five to fifteen grains, and as a tonic from one to three or four grains.

There are but few instances in which this poison has proved fatal in the human subject. In 1836, a girl, sixteen months old, put some pieces of *Blue stone* (sulphate of copper) which were given her to play with, into her mouth. In a quarter of an hour, the child vomited a bluish-green coloured matter, with pieces of sulphate of copper in it; the skin was alternately cold and hot, but there was neither diarrhœa nor convulsions. The child died in *four hours*, and was insensible before death. (Med. Gaz. xviii. p. 742.) The coroner and jury did not consider it necessary that an inspection should be made; and yet in the event of murder being committed by the administration of this substance, it would be somewhat unreasonably expected that medical witnesses should be fully acquainted with the post-mortem appearances produced by it!

Post-mortem appearances.—In poisoning by the salts of copper, the mucous membrane of the stomach and intestines has been found more or less thickened and inflamed in the few fatal cases which have been hitherto examined: the mem-

brane has been also found eroded and softened in poisoning by verdigris. The œsophagus has presented an inflammatory appearance. In a case of poisoning by Verdigris, quoted by Orfila, the stomach was inflamed and thickened, especially towards the pylorus, the orifice of which, from the general thickening, was almost obliterated. The small intestines were throughout inflamed, and perforation had taken place, so that part of the green liquid was effused into the abdomen. The large intestines were distended in some parts and contracted in others, and the rectum was ulcerated on its inner surface. (Toxicologie, i. 623.) The lining membrane of the alimentary canal is often throughout of a deep green colour, owing to the small particles of verdigris adhering to it. It has been said that this is an uncertain character of poisoning by copper; since a morbid state of the bile often gives a similar colour to the mucous membrane of the stomach and duodenum. This objection cannot apply, when the green colour is found in the œsophagus, and throughout the intestines; and, under any circumstances, the evidence, from the presence of a green colour would amount to nothing, in the judgment of a prudent witness, unless copper were freely detected in the parts so coloured. It is well to remember, that the green stain, if due to copper, would be turned blue by ammonia. In death from arsenite of copper, the inflammatory appearances would probably be more strongly marked.

Verdigris. Subacetate of Copper.

This salt produces symptoms somewhat similar to those caused by the sulphate. There is a strong styptic metallic taste, with a sense of constriction in the throat, followed by severe colicky pains,—vomiting of a green-coloured liquid, diarrhœa, and tenesmus. In a case reported by Phyl, a woman who took *two ounces* of verdigris died in three days: in addition to the symptoms above described, there were convulsions and paralysis before death. Niemann relates that a female, aged twenty-four, swallowed *half an ounce* of verdigris, and died under symptoms of violent gastric irritation in sixty hours. (Taschenbuch, 458.) In consequence of the great uncertainty of its operation, subacetate of copper is not employed internally.

Subchloride of Copper.

This is a rich green compound known as Oxychloride or Brunswick green. It is formed when common salt has been used in a copper vessel, and has thus given rise to accidental poisoning. It is also used as a pigment.

Carbonate of Copper.

A case of poisoning by this substance has been reported by M. Desgrange, of Bordeaux. A man died in about six hours, as it was supposed, from the effects of an unknown quantity of this poison which he had taken. When first seen he was comatose; he had sustained some violence from a fall, and there was great coldness of the extremities. There was neither vomiting, purging, nor pain in the abdomen on pressure. On inspection, the œsophagus and stomach were covered with a green-coloured substance. The larger extremity of the stomach was vascular, and the mucous membrane of the intestine, as well as the liquid contained in them, was green. Carbonate of copper was found in the stomach, and traces of the metal existed in the urine—none was found in the blood. (Med. Gaz. xxxi. 495.) It is remarkable that in this case there should have been neither vomiting nor diarrhœa. The poison seems to have acted more like a narcotic than an irritant.

Arsenite of Copper.

This compound, which is known under the name of Scheele's,—Emerald or Mineral Green, contains about half its weight of arsenic. It is extensively used as a pigment in the arts; it is also improperly employed to give a green colour to wafers and articles of confectionary.

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Symptoms and Effects.—A child, aged three years, swallowed a small capsule of Scheele's green, used by his father as a pigment. In half an hour he complained of violent colic: there was frequent vomiting, with diarrhœa, cold sweats, intense thirst, and retraction of the parietes of the abdomen. The mouth and fauces were stained of a deep green colour. Hydrated sesquioxide of iron was given: in about an hour the vomiting and diarrhœa ceased, and soon afterwards the thirst and pain in the abdomen abated. The next morning the child was well. In another case, a child, a year old, ate several pieces of a cake of arsenite of copper, used for colours. There was immediate vomiting, the liquid containing green-coloured particles of the arsenite, but there were no other urgent symptoms. White of egg with sugared water was given to it. After a short time the child became pale, and complained of pain in the abdomen; the pulse was frequent, the skin cold, and there was great depression. Copious diarrhœa followed, soon after which the child recovered. (Galtier, i. 636.)

In the cases of two children poisoned by confectionary coloured with this substance, the chief symptom was incessant vomiting of a light green-coloured liquid, resembling bile diluted with water. Mr. Bulley, of Reading, who reports these cases (Medical Times, April 28, 1849, page 507,) describes the symptoms as very severe, although the quantity of poison swallowed was small. Under the use of an emetic of ipecacuanha the children recovered. A case was communicated to me in July 1849, by Mr. J. B. Hicks, in which a child, aged seven years, ate a slice of cake with part of a green ornament on it. There was severe pain with thirst, burning sensation in the throat, with constant vomiting, but no purging. The child recovered in three days. The green pigment was found to be pure arsenite of copper mixed with sugar. (Guy's Hosp. Reports, Oct. 1850, p. 218. See also Med. Gaz. vol. xliii. p. 304.) In a case which was the subject of a criminal trial, this deadly compound was proved to have caused the death of a gentleman by reason of its having been employed to give a rich green colour to some confectionary served at a public dinner. It was ignorantly used to give a colour to some blanc-mange:—the party who employed it considering that emerald or mineral green was nothing more than an *extract of spinach!* It led to death under the usual symptoms, and the parties were convicted of manslaughter and sentenced to imprisonment. (*Reg.* v. *Franklin and Randall*, Northampton Summer Assizes, 1848.) Most of the colours used for confectionary are of a poisonous nature: the pink colour given by cochineal or madder is the only one which can be regarded as innocent. [A case occurred under our observation some years ago. in which a boy five years old died, with all the symptoms of poisoning by copper, just two years after having swallowed a brass button: see Beck ii. 609, 610, for other like cases.—H.]

Chemical analysis of the Salts of Copper.—The salts of copper are generally known by their colour: whether in the solid state or in solution, they are either blue or green. The salts of one other metal are also of a green colour, namely nickel; but there are striking chemical differences between the salts of this metal and those of copper. There are *three* very *soluble* salts of copper; two of these are blue, the sulphate and nitrate,—and one green, the chloride. The solutions of the cupreous salts have generally an acid reaction. The salt should be dissolved in water, diluted, and the following tests may then be applied.

Tests.—1. *Solution of ammonia:* this gives, in a solution of copper, a bluish-white precipitate, which is soluble in an excess of the test, forming a deep violet-blue solution. 2. *Ferrocyanide of potassium*, a rich claret-red precipitate:—if the quantity of copper be small, the liquid acquires merely a light-red colour; if large the precipitate is of a red-brown colour, and of a gelatinous consistency. The ferrocyanide of potassium will act on the violet-blue solution produced by ammonia, provided it be much diluted, or an acid added (sulphuric) to neutralize the ammonia. One portion of liquid may thus be tried by the two tests. 3. *Sulphuretted hydrogen gas*, or hydro-sulphuret of ammonia, gives a deep

chocolate-brown precipitate, even in an acid solution; or if the copper be in small proportion, merely a light-brown colour. 4. A slip of *Polished Iron* (a common needle) suspended by a thread in the liquid, is speedily coated with a layer of copper, even when the salt is in very small proportion. When much diluted, a drop of diluted sulphuric acid may be added. If the needle be left for some days in the liquid, the iron will be slowly removed, and a hollow cylinder of metallic copper will remain. This may be dissolved in diluted nitric acid, and tested with the foregoing tests; or the needle coated with copper, may be immersed in ammonia and exposed to air. The liquid then becomes slowly blue. Half a grain of sulphate of copper dissolved in sixteen ounces of water, may be thus easily detected. It was long since proposed by Orfila to substitute *Phosphorus* for polished iron. This substance most effectually separates metallic copper from its salts, even when they are dissolved in organic liquids. 5. *The Galvanic test.* If a few drops of the copper solution be placed on platina-foil, slightly acidulated with a diluted acid, and the platina be then touched through the solution with a thin slip of zinc, metallic copper, of its well known red colour, is immediately deposited on the platina. When the quantity of copper is small there is merely a brown stain; but a blue liquid is formed by pouring on it ammonia, and exposing it to air.

Copper in organic liquids.—The oxide of copper is liable to be precipitated by certain organic principles, as albumen, fibrin and mucous membrane: but some of these organic compounds are easily dissolved by acids or even by an excess of the solution of cupreous salt. A portion at least of the salt of copper is, therefore, commonly held dissolved. In such cases, there is one peculiar character possessed by these liquids, *i. e.* they have a decidedly *green colour* even when the copper-salt is in a far less than poisonous proportion.

Separation by iron.—We first filter the liquid, and save the insoluble portions for a separate operation. We may use as a trial-test either a needle, zinc with platina, or add to a portion, oxalic acid: the last gives a bluish-white precipitate only when the copper is in a moderately large quantity, and the liquid is not very acid. If the needle be not coated with copper in the course of a few hours, it is certain that there is no detectable quantity of the poison present in the liquid.

Separation as a sulphuret.—If the copper salt be present in *large* quantity, any of the trial-tests will indicate it immediately. We now destroy the viscidity of the liquid by diluting it if necessary, and pass into it a current of sulphuretted hydrogen gas in order to precipitate all the copper in the state of sulphuret. The black sulphuret may be collected, washed, dried, and then boiled in equal parts of nitric acid and water for a quarter of an hour. Nitrate and sulphate of copper are produced and dissolved,—a fact indicated by the liquid acquiring a rich blue colour; and some sulphur is at the same time separated. This liquid, when filtered, will give the usual reactions with the tests for copper.

Separation by platina.—I have also found the following a very expeditious and simple method of obtaining copper from organic liquids. Having filtered the liquid, let a portion of it be placed in a clean platina capsule or crucible. A few drops of diluted sulphuric acid may be added, and a slip of zinc foil introduced. Wherever the platina is touched by the zinc, metallic copper is deposited; and after having in this way coated the platina capsule, the surplus liquid may be poured off and the capsule well washed out. The copper is then dissolved in diluted nitric acid, and the tests may be applied after the excess of acid has been driven off by heat. This is, perhaps, the most expeditious and certain method of detecting a salt of copper in an organic liquid. It is, however, less delicate than the Iron-test.

Copper in articles of food.—The Medico-legal history of poisoning by copper would be incomplete without some remarks on the action of certain articles of food on this metal when used for culinary purposes. This is a not unfrequent form of accidental poisoning. The symptoms rarely appear until after the lapse

of three or four hours. There is commonly nausea, with colicky pains and cramps in the limbs. It results from the experiments of Falconer and others, that metallic copper undergoes no change by contact with *water*, unless air be present, when a hydrated carbonate will be formed mixed with peroxide. If the water contain any acid, such as vinegar, or common salt, or if there be oily or fatty matter in contact with the metal, then the copper is more rapidly oxidised, and the liquid or fat acquires a green colour. If the copper vessel be kept perfectly clean, and the food prepared in it be allowed to cool in other vessels, there is not much risk of its acquiring a poisonous impregnation: nevertheless, no acid, saline, fatty, or oily liquid should be prepared as an article of food in a copper vessel. (See Ann. D'Hyg. 1832, i. 102.) Under the influence of heat and air, a portion of copper becomes dissolved, and the oily or other liquid acquires a green colour. The preparation of fruits, such as preserves, in copper vessels, is necessarily attended with some risk; for on cooling, a green crust is apt to form on the copper, just above the surface where the air and acid liquid meet. Some liquids while boiling appear to be but little liable to this impregnation:—thus, coffee, beer, milk, or tea, has been boiled for two hours together, in a clean copper vessel, without any portion of the metal being taken up by either of the liquids. (See Falconer, on the Poison of Copper, 65. London, 1774; also Orfila, i. 611.) Accidents of this kind are usually prevented by lining the copper vessel with tin; but in very large boilers this plan is not always adopted—cleanliness alone is trusted to, and this is a sufficient preventive when properly observed.

It has been stated that an impure alloy used by some of the lower grade of dentists has been so largely composed of copper, as to affect the health of those who have used the plates for the support of artificial teeth. The acid and salts in the saliva would facilitate the production of a poisonous salt of copper.

In the making of preserved *fruits* and vegetable *pickles*, the salts of copper (blue vitriol) are sometimes used for the purpose of giving a rich green colour. Many of the green pickles sold in shops are thus impregnated with the vegetable salts of this metal, to which they owe their bright grass-green colour. If the fruit or pickle be placed in a solution of ammonia, and copper be present, the substance is speedily turned blue. The iron test is, however, more delicate. A bright needle immersed in the pickle, or plunged into the solid, will be speedily coated with copper. The quantity of copper contained in such articles may not be sufficient to cause fatal effects, but serious symptoms of gastric irritation are sometimes produced, and in very young subjects these may assume an alarming character. (See Falconer, 87.)

CHAPTER XIII.

TARTARIZED ANTIMONY—SYMPTOMS—RECOVERY FROM LARGE DOSES—POST-MORTEM APPEARANCES—TREATMENT—CHEMICAL ANALYSIS—TESTS. ANTIMONY IN ORGANIC LIQUIDS. CHLORIDE OF ANTIMONY—ANALYSIS. POISONING BY SULPHATE AND CHLORIDE OF ZINC—CARBONATE OF ZINC. PREPARATIONS OF TIN—SILVER—GOLD—IRON—BISMUTH AND CHROME—BICHROMATE OF POTASH.

Tartarized Antimony. Tartar Emetic. Stibiated Tartar.

Symptoms and effects.—This substance, which is seen in the form of a white powder, or in crystals, is by no means so poisonous as it is often described to be. Forty grains have been given to an adult in twenty-four hours without causing serious mischief. When taken in a poisonous dose, a strong metallic

taste is perceived in the mouth during the act of swallowing. There is violent burning pain in the epigastric region, followed by nausea, incessant vomiting, profuse diarrhœa and syncope. The pulse is small and rapid, sometimes imperceptible; the skin cold, and covered with a clammy perspiration; and the respiration painful. Death is preceded by vertigo, insensibility, great prostration of strength, and violent spasms of the muscles of the extremities. Among the symptoms there has been observed great heat and constriction in the throat, with difficulty of swallowing. The *quantity* actually required to destroy life is unknown. It will probably depend in some degree on whether active vomiting and purging have been excited or not; for these symptoms have not been present in all cases. Doses of twenty, twenty-seven, and even sixty grains have been taken without destroying life, although alarming symptoms of irritation followed. In one case related by Orfila, a man, aged fifty, took forty grains of tartar emetic, and died in about four days. This was the only one out of five cases of poisoning by this substance which proved fatal. (Orfila, i. 447.) Dr. Beck mentions a case in which fifteen grains of tartar emetic, in solution, killed a child in a few weeks: vomiting and purging ensued, followed by convulsions and death. This case proves that a patient is not always saved by vomiting and purging:—the fatal effects on such an occasion are probably due to rapid absorption. (See also Medical Gazette, vol. xliv. p. 334.) Dr. Pollock has recorded a case in which an adult was killed in ten hours by a dose of one drachm, in spite of early and violent vomiting. (Med. Gaz. vol. xlv. p. 801.) In two cases observed by Mr. Hartley, which will be presently described, *ten grains* killed each child in a few hours. This, I believe, is the *smallest fatal dose* on record. In a case recently reported by Mr. Freer, of Stourbridge, a man, ætat. 28, swallowed *two drachms* of tartar emetic by mistake for Epsom salts, and recovered from its effects. An hour after the poison had been taken, he was found in the following state:—his pulse imperceptible; tongue dry and red; countenance cold and livid, bathed with clammy perspiration, and indicative of great suffering; violent pain at the epigastrium and over the whole of the abdomen, with constant spasmodic contraction of all the muscles, particularly of the abdomen and upper extremities. The fingers were firmly contracted, and the muscles quite rigid. He vomited only once, about *half an hour* after he had swallowed the poison, and after this he had constant involuntary aqueous stools. An emetic of mustard and salt was given to him, and this produced violent vomiting of bilious matter. Green tea, brandy, and decoction of oak-bark were freely given. The cramps, vomitings, and aqueous stools continued for six hours. The symptoms then became mitigated, and he gradually recovered, suffering chiefly from profuse night perspirations. (Lancet, May 22d, 1847, 535.) This case is remarkable for the anomalous character of the symptoms, as, in the absence of active vomiting, an emetic was actually required to be given,—also for the recovery of the individual after a very large dose of the poison.

Dr. Gleaves, U. S., has related, in the Western Journal of Medicine and Surgery, the following singular case of recovery:—A young man swallowed, by mistake, a *tablespoonful* of tartar emetic. In an hour after, he was speechless, pulseless, and apparently dying. Although he drank freely of cold water, and irritated his fauces repeatedly with his finger, no vomiting had occurred. During the first three hours he vomited only two or three times, and the matter ejected was chiefly the warm water taken to favour vomiting. After the lapse of two hours there was the most violent purging. In seven hours this ceased, and there was great thirst, with a sense of burning pain in the fauces, œsophagus, stomach, and bowels. There was also great irritability of the stomach, and the vomited matters were tinged with blood. On the following day the vomiting continued, but the purging was arrested. The fauces were covered with pustules: there was pain in passing the urine, which was copious. On the third day, the whole of the body was covered with genuine tartar emetic pustules.

These began to heal, and the patient to recover, in about two weeks. (Med. Times, Jan. 24, 1846, p. 127.) This is the only case of poisoning by tartar emetic in which pustular eruptions have been observed. It is otherwise remarkable for recovery from so large a dose, considering that but little of the poison could have been expelled in the first instance by vomiting.

Post-mortem appearances.—The following cases, reported by Mr. Hartly, show the nature of the post-mortem appearances likely to be found in the body:—Two children, a boy aged five years, and a girl aged three years, each swallowed a powder containing *ten grains* of tartar emetic mixed with a little sugar. It was stated that, in twenty minutes after taking the powders, they were seized with violent vomiting and purging, and great prostration of strength, followed by convulsions and tetanic spasms: there was also great thirst. The boy died in eight hours, and the girl in twelve or thirteen hours after swallowing the dose. The bodies were inspected between four and five days after death. In that of the boy there was effusion of serum in the right pleura; the lower lobe of the right lung posteriorly was redder than natural, and the peritoneum was injected from recent inflammation. The mucous membrane of the duodenum was inflamed, and covered with a whitish yellow viscid secretion; this was observed throughout the intestinal canal, although the colour was of a deeper yellow in the colon and rectum: there was no ulceration. The peritoneal coat of the stomach was inflamed. The mucous membrane of this organ was much inflamed, especially about the larger curvature and at the cardiac orifice: there was no ulceration. The contents, (about two ounces and a half of a dark grumous fluid, having a slightly acid reaction,) were very adherent to it; and in one place there was a patch of lymph. The tests used did not indicate the presence of antimony. With regard to other appearances, the tongue was covered with a white fur, and appeared soddened; the fauces were not inflamed; the trachea and œsophagus had a natural appearance. On opening the cranium, the dura mater was found very vascular; the longitudinal sinus contained a coagulum of lymph, and but very little blood. The vessels of the surface of the brain were very much injected with dark blood, the whole surface having a deep purple colour. Every portion of the brain, when cut, presented many bloody points. The cerebellum and medulla oblongata were also extremely vascular; there was no effusion in the ventricles or at the base of the brain. In the body of the girl, the morbid appearances were similar; there were also patches resembling the eruption of scarlatina on the arms, legs, and neck. The arachnoid membrane was more opake than usual; and on the mucous membrane of the stomach, where the inflammation was greatest, were two or three white spots, each about the size of a split pea, which appeared to be the commencement of ulceration. (Lancet, April 25, 1846, 460.) In animals poisoned by this substance, it is common to find general inflammation of the alimentary canal.

Chemical analysis. Tartar emetic as a solid.—In the state of powder.—1. Tartar emetic is easily dissolved by water,—it is taken up by fourteen parts of cold and two of boiling water; the solution has a faint acid reaction, and an acrid caustic taste; it becomes decomposed by long keeping. It is insoluble in alcohol. 2. The powder dropped into hydrosulphuret of ammonia, is turned of a deep reddish brown colour, and is thereby known from other poisonous metallic salts. 3. When heated in a reduction-tube, it becomes charred, but does not melt before charring, like the acetate of lead. The metal is partially reduced by the carbon of the vegetable acid, and the decomposed mass has a grayish-blue lustre. I have not found that a metallic sublimate is produced in this experiment by the heat of a spirit-lamp. 4. When boiled with muriatic acid and metallic copper, a gray deposit of antimony takes place on that metal. The colour of the deposit is violet, if the quantity be very small.

Tartar emetic in solution.—1. On slowly evaporating a small quantity on a slip of glass, it will crystallise in *tetrahedra*. If obtained from a very diluted

solution, this crystallization resembles that of arsenic. 2. *Diluted nitric acid* added to the solution, throws down a white precipitate (subnitrate of antimony:) the other two mineral acids act in the same way; but, as they precipitate numerous other metallic solutions, there are objections to them which do not hold with respect to nitric acid. The white precipitate thus formed possesses the remarkable property of being easily and entirely redissolved by a solution of tartaric acid:—it is also soluble in a large excess of nitric acid, so that if much of the test be added at once, no precipitate is produced. 3. *Ferro-cyanide of potassium* does not precipitate the solution, whereby tartar emetic is known from most other metallic poisons. 4. *Hydrosulphuret of ammonia* or *sulphuretted hydrogen gas* produces in the solution a reddish orange-coloured precipitate, differing in colour from every other metallic sulphuret.

The foregoing tests, it will be observed, merely indicate the presence of oxide of antimony,—but this is in reality the poison which we have to seek,—the cream of tartar with which it is combined being merely the vehicle; and in a case of poisoning, this is no more the object of medico-legal research than if it were the vehicle for the administration of arsenic or corrosive sublimate. It is, besides, well known that tartar emetic is the only salt of the oxide of antimony in a soluble form which is likely to be met with in medicine or chemistry. Should it be required to prove the presence of cream of tartar, this may be done by filtering a solution from which the oxide of antimony has been entirely precipitated by sulphuretted hydrogen gas. On evaporating this solution, the cream of tartar may be obtained.

In liquids containing organic matter.—Tartar emetic is precipitated by tannic acid in all its forms, but not readily by albumen or mucous membrane; therefore it may be found partly dissolved in the liquids of the stomach, provided no antidote has been administered. The liquid must be filtered, and then strongly acidulated with tartaric acid. A current of sulphuretted hydrogen gas is now passed into it, until there is no further precipitation. The sulphuret is collected, washed, and dried. If it be the sulphuret of antimony, it will have an orange-red or brown colour, and will, when dried, be dissolved by a small quantity of boiling muriatic acid (forming sesquichloride of antimony) with the evolution of sulphuretted hydrogen. The boiling should be continued for several minutes. On adding this solution to a large quantity of water, a dense white precipitate of oxychloride of antimony (powder of Algaroth or Algarotti, *Mercurius Vitæ*) will fall down. This is characteristic of antimony. If it be objected that nitrate of *bismuth* undergoes a similar change when dropped into water, hydrosulphuret of ammonia will easily enable us to distinguish the two metals; the antimonial precipitate is turned of an orange-red by that solution, while the bismuthic precipitate is turned of a deep black.

A medical jurist must remember that the discovery of tartar emetic in the contents of a stomach is by no means a proof of its having been taken or administered as a poison; since it is frequently prescribed as a medicine, and often taken as such by persons of their own accord. We could only infer that it existed as a poison, or had caused death, when the quantity present was very large, and there were corresponding appearances of irritation in the alimentary canal. Still less would the discovery of it in a medicinal mixture, unless in a very large proportion, be evidence of an intent to poison.

In the tissues.—Orfila has successfully applied Marsh's process for arsenic to the detection of antimony in the tissues. (For the details of this process I must refer to my work ON POISONS, p. 490.) Reinsch's process also serves to separate antimony from the soft parts when they are boiled for some time in muriatic acid and water. The copper acquires a violet-blue or steel-gray colour (resembling arsenic,) according to the proportion present. This separation of antimony from the tissues does not necessarily indicate that it has been criminally administered or has caused death. In a recent case of suspected death from

poison, a deposit on copper, evidently of an antimonial nature, was obtained by boiling part of the liver in hydrochloric acid and water. The boy had died from natural causes; and, on inquiry, it was found that a dose of antimonial powder had been given to him shortly before death.

Chloride of Antimony. Sesquichloride or Butter of Antimony.

Symptoms and appearances.—The following case was communicated to me by Mr. Henry Pearson:—In 1836, a boy, aged 12, swallowed by mistake for ginger beer four or five drachms of a solution of butter of antimony. In half an hour he was seized with vomiting, which continued at intervals for two hours. There was faintness, with general weakness, and great prostration of strength. Remedial means were adopted, and the next day the chief symptoms were heat and uneasiness in the mouth and throat, with pain in swallowing. There were numerous abrasions on the mucous membrane of the mouth and fauces; and there was slight fever, from which he quite recovered in about eight days. Another case of recovery from a dose of an ounce is reported in the Lancet, Feb. 26, 1848, p. 230.

The only fatal case which I have met with was communicated to me by Mr. Mann, of Bartholomew Close. An army surgeon swallowed, for the purpose of suicide, from two to three ounces by measure of chloride of antimony. About an hour afterwards he was seen by Mr. Mann. There was entire prostration of strength, with coldness of skin, and incessant attempts to vomit. The most excruciating griping pains were felt in the abdomen; and there was a frequent desire to evacuate the bowels, but nothing was passed. In the course of a few hours reaction took place, the pain subsided, and the pulse rose to 120. There was now a strong disposition to sleep, so that he appeared as if labouring under the effects of a narcotic poison. In this state he continued until he died,—ten hours and a half after he had swallowed the poison. On inspection, the interior of the alimentary canal, from the mouth downwards to the jejunum, presented a black appearance, as if the parts had been charred. In general, there was no mucous membrane remaining, either on the stomach or elsewhere; only a flocculent substance, which could be easily scraped off with the back of the scalpel, leaving the submucous tissue and the peritoneal coat. All these parts were so soft that they were easily torn by the fingers.

Chemical analysis.—If any portion of the chloride be left in the vessel, it may be tested by adding a few drops to a large quantity of water, when the whitish-yellow oxychloride of antimony will be precipitated: the supernatant liquid will contain muriatic acid, which may be detected by nitrate of silver. It has been already observed, that the only objection to this mode of testing is, that the salts of *bismuth* are also decomposed by water; but the precipitate in this case is insoluble in tartaric acid, and is blackened by hydrosulphuret of ammonia; while in the case of antimony it is soluble in that acid, and is changed to an orange-red by the hydrosulphuret.

Preparations of Zinc.—Sulphate of Zinc. White Vitriol or White Copperas.

Symptoms and appearances.—The symptoms produced by an over-dose of sulphate of zinc are pain in the abdomen and violent vomiting, coming on almost immediately, and diarrhœa. After death, the stomach has been found inflamed. The sulphate appears to act as a pure irritant; it has no corrosive properties.

Chemical analysis.—The pure sulphate is seen in white prismatic crystals, closely resembling in appearance sulphate of magnesia and oxalic acid; from oxalic acid it is distinguished by remaining fixed when heated on platina foil,—from the sulphate of magnesia, by tests applied to its solution. It is readily dissolved by water, this fluid taking up about one-third of its weight at common

temperatures. Analysis of the *solution*.—The solution in water has a slightly acid reaction. The following tests may be used for the detection of oxide of zinc:—1. *Ammonia* gives a white precipitate, soluble in an excess of the alkali. 2. *Sesquicarbonate of ammonia*, a white precipitate, also soluble in a large excess of the test. 3. *Ferrocyanide of potassium*, a white precipitate. 4. *Sulphuretted hydrogen* and hydrosulphuret of ammonia, a milky white precipitate, provided the solution be *pure* and neutral, or nearly so. If the solution be very acid, sulphuretted hydrogen produces no effect whatever.

In organic mixtures.—If the sulphate of zinc be dissolved, we may pass into the solution a current of sulphuretted hydrogen gas; the presence of zinc is immediately indicated by a milky-white froth—the sulphuret may be collected, and decomposed by boiling it with muriatic acid. The solution may be then tested for zinc.

Chloride of Zinc.

Since the publication of the previous edition of this work, the attention of the profession has been directed to the subject of poisoning by Chloride of zinc by Dr. Stratton and others. The chloride of zinc is sold to the public as a disinfectant under the name of "Sir W. Burnett's fluid." This is a highly concentrated solution of the impure chloride of the metal: it has been taken by accident in several cases, and in one instance was supposed to have been criminally administered as a poison.

Symptoms.—In one of the cases reported by Dr. Stratton, about two ounces of a solution containing only twelve grains of the chloride were swallowed. The patient immediately felt pain and nausea; vomiting followed, and she recovered, but suffered from some indisposition for three weeks. In a second case, a wineglassful, equivalent to at least two hundred grains of solid chloride, was swallowed. The man instantly experienced burning pain in the gullet, burning and griping pain in the stomach, great nausea, and coldness. Vomiting came on in two minutes; the legs were drawn up to the body; there were cold perspiration, and other signs of collapse. The man perfectly recovered in sixteen days. (Ed. Med. and Surg. Journal, Oct. 1848, p. 335; and British American Journal, Dec. 1848, p. 201.) Other cases show that the concentrated liquid has a strong corrosive action locally, destroying the membrane of the mouth, fauces, gullet, and stomach. There has been frothing of the mouth, general lividity, with coldness of the surface. In one case, in which only a mouthful of the fluid had been swallowed, with immediate burning heat in the stomach, the patient experienced giddiness and loss of sight: vomiting and purging came on, and the former symptom continued for a week. There was so much irritability of the stomach for a period of three weeks, that the woman became greatly reduced. Among the early symptoms was loss of voice, which did not return for five weeks. (Med. Times, Oct. 11, 1851, p. 382; and Nov. 8, 1851, p. 497.)

Post-mortem appearances.—Out of five cases of poisoning by this substance within the last four years, only one has proved fatal: this was in the case of an infant aged fifteen months. The lining membrane of the mouth and fauces was white and opake. The stomach was hard and leathery, containing a liquid like curds and whey. Its inner surface was corrugated, opake, and tinged of a dark leaden hue. The lungs and kidneys were congested. The fluid of the stomach was found to contain chloride of zinc. (Med. Times, July 13, 1850, p. 47.)

These facts show that the concentrated solution of chloride of zinc is both a corrosive and an irritant poison, exerting also a powerful action on the nervous system. It may destroy life by producing stricture of the œsophagus, or by its chemical action on the lining membrane of the stomach, leading to a loss of power of digestion, emaciation, and exhaustion.

Analysis.—The chlorine may be discovered by nitrate of silver—the zinc by

the tests above described. (See Sulphate.) All the samples which I have examined contained iron.

Carbonate of Zinc (Calamine.)

This compound does not appear to have any poisonous action; and it would probably require to be given in large quantity to produce any effect. Carbonate of zinc is the white substance which is formed on the metal when long exposed to air and moisture. Its effects may become a subject of investigation as a matter of medical police; since zinc is now much used for roofing, and also in the manufacture of water-pipes and cisterns. (See Ann. d'Hyg. 1837, 281, ii. 352.)

Preparations of Tin.

The only preparations of this metal which require to be noticed as poisons are the *Chlorides*, or *Muriates*, a mixture of which is extensively used in the arts under the name of *Dyer's spirit*. The salts may exist in the form of whitish-yellow crystals; but more commonly they are met with in a strongly acid solution in water. They are irritant poisons; but so seldom used as such that only one death occurred from them in England and Wales during a period of two years.

Preparations of Silver.

Nitrate of Silver. Lunar Caustic. Lapis Infernalis.—This substance, which is commonly met with in small sticks of a white or dark gray colour, is readily soluble in distilled water; in common water it forms a milky solution. It acts as a powerful corrosive, destroying all the organic tissues with which it comes in contact. There are at least two cases on record in which it has proved fatal in the human subject:—one of these occurred in 1837-8, but the particulars are unknown. The symptoms come on immediately, and the whitish flaky matter vomited is rendered dark by exposure to light. Dark coloured spots on the skin will also indicate the nature of the poison.

Preparations of Gold.

Terchloride.—This is the only preparation of gold which requires notice. It is a powerful irritant poison, acting locally like the nitrate of silver. Nothing is known of its effects on the human subject; but in administering it to animals, Orfila has found extensive inflammation, and even ulceration of the mucous membrane of the stomach. (Toxicologie, ii. 30.) The metal is absorbed and carried into the tissues, but its poisonous action is wholly independent of absorption.

Preparations of Iron.

Sulphate of Iron. Copperas. Green Vitriol.—This compound has been several times administered with malicious intention. One death from this substance took place in 1837-8. It cannot, however, be a very active preparation; for a girl who swallowed an ounce of it recovered, although she suffered for some hours from violent pain, vomiting and purging. (Christison on Poisons, 506.)

Green vitriol or copperas is sometimes given as an abortive. A suspicious case is reported, in which a woman far advanced in pregnancy, but enjoying good health, was suddenly seized about midnight with vomiting and purging, and died in about fourteen hours. The body was disinterred, and iron found in large quantity in the viscera. The symptoms are not always of this violent kind. In a case which occurred to M. Chevallier, a husband gave a large dose of sulphate of iron to his wife. There was neither colic nor vomiting. The woman lost her appetite, and she had a clayey complexion, but she ultimately recovered.

Muriate of Iron. Tincture of sesquichloride of Iron.—This is an acid solution of peroxide of iron with alcohol, of a red colour, much used in medicine. Dr. Christison relates an instance where a man, by mistake, swallowed an ounce and a half of this liquid: the symptoms were somewhat like those produced by muri-

atic acid. He at first rallied, but died in about five weeks. The stomach was found partially inflamed, and thickened towards the pylorus. This salt has been of late much used for criminal purposes in France. (See Med. Gaz. vol. xlvii. p. 307; also Ann. d'Hyg. 1850, i. p. 180, 416—and 1851, i. p. 155, ii. 337.) A case was reported to the Westminster Medical Society, in November, 1842, in which a girl, aged fifteen, five months advanced in pregnancy, swallowed an ounce of the tincture of muriate of iron in four doses in one day, for the purpose of inducing abortion. Great irritation of the whole urinary system followed; but this was speedily removed, and she recovered. Another case of recovery from a large dose of this preparation has been recently reported by Mr. Amyot. A healthy married female swallowed, by mistake for an aperient draught, *one ounce and a half* of the tincture of muriate of iron. She immediately ejected a portion, and violent retching continued for some time. There was great swelling of the glottis, with cough, and difficulty of swallowing. These symptoms were followed by heat and dryness of the throat, with a pricking sensation along the course of the œsophagus and stomach; and in the afternoon a quantity of dark grumous blood was vomited. The motions were black, owing doubtless to the action of sulphur upon the metal. In about a month the patient was perfectly restored to health. (Provincial Journal, April 7 and 21, 1847, 180.) Another case of recovery from a large dose has been reported by Sir James Murray. The patient, æt. 72, swallowed by mistake *three ounces* of the tincture in a concentrated state. The tongue soon became swollen; a ropy mucus flowed from the mouth and nose; there was croupy respiration, with a sense of impending suffocation. The pulse was feeble, the skin cold and clammy, and the face swollen and livid. A castor oil mixture brought away inky evacuations, and the patient rapidly recovered. (Dub. Med. Press, Feb. 21, 1849.)

Chemical analysis.—The muriatic acid may be detected by nitrate of silver and nitric acid, while the peroxide of iron is immediately indicated by a precipitate of Prussian blue on adding a solution of *Ferrocyanide of potassium.*

Preparations of Bismuth.

Subnitrate of Bismuth. Pearl-white. Magistery of Bismuth.—This substance, in a dose of *two drachms*, caused the death of an adult in nine days. There was burning pain in the throat, with vomiting and diarrhœa, coldness of the surface, and spasms of the extremities,—also a strong metallic taste in the mouth. On inspection, the fauces, larynx, and œsophagus were found inflamed; and there was inflammatory redness in the stomach and throughout the intestinal canal. (Sobernheim, 335.) In a case mentioned by Dr. Traill, a man took by mistake *six drachms* of the subnitrate, in divided doses, in three days. He suffered from vomiting and pain in the abdomen and throat, but finally recovered. (Outlines, 115.) These cases are sufficient to prove that a substance very slightly soluble in water, may exert a powerfully poisonous action on the human system.

Preparations of Chrome.

Bichromate of Potash.—Well observed instances of poisoning by this compound, which is now extensively used in the arts, are rare; and, therefore, the details of the following case, communicated to the Medical Gazette (xxxiii. 734) by Mr. Wilson of Leeds, are of great practical interest:—A man, aged sixty-four, was found dead in his bed, twelve hours after he had gone to rest. He had been heard to snore loudly during the night, but this had occasioned no alarm to his relatives. When discovered, he was lying on his left side, his lower extremities being a little drawn up to his body: his countenance was pale, placid, and composed; eyes and mouth closed; pupils dilated; no discharge from any of the outlets of the body; no marks of vomiting or diarrhœa, nor any stain upon his hands or person, or upon the bed-linen or furniture. The surface was

moderately warm. Some dye-stuff, in the form of a black powder, was found in his pocket. On inspection, the brain and its membranes were healthy and natural; there was neither congestion nor effusion in any part. The thoracic viscera were equally healthy, as well as those of the abdomen, with the exception of the liver, which contained several hydatids. A pint of a turbid inky-looking fluid was found in the stomach. The mucous membrane was red and very vascular, particularly at the union of the cardiac extremity with the œsophagus: this was ascribed to the known intemperate habits of the deceased. In the absence of any obvious cause for death, poison was suspected; and on analyzing the contents of the stomach, they were found to contain bichromate of potash. The dye-powder taken from the man's pocket consisted of this salt mixed with cream of tartar and sand. It is remarkable that in this case there was neither vomiting nor purging. The salt does not appear to have operated so much by its irritant properties as by its indirect effects on the nervous system. This, however, is by no means an unusual occurrence, even with irritants far more powerful than the bichromate of potash. A case has been recently communicated to me by Mr. Bishop, of Kirkstall, in which a boy recovered from the effects of a dose of this salt only after the lapse of four months. The first symptoms were pain, vomiting, dilated and fixed pupils, cramps in the legs, and insensibility. His recovery was due to early and active treatment. A report of this case will be found in Guy's Hosp. Reports, Oct. 1850, p. 214.

There can be no doubt that this salt is a very active poison. Mr. West has recently published a case from which it appears that a medical man, who had inadvertently tasted a solution of bichromate of potash, suffered from very severe symptoms, resembling those of Asiatic cholera. (Provincial Journal, Dec. 24, 1851, p. 700.)

[Several fatal cases from this poison have occurred in this country, especially at Baltimore, where this salt is manufactured on a large scale. They all appear to have been the result of accident.—H.]

VEGETABLE IRRITANTS.

CHAPTER XIV.

GENERAL REMARKS.—MODE OF ACTION OF VEGETABLE IRRITANTS. ALOES. COLOCYNTH. GAMBOGE. JALAP. SCAMMONY. SAVIN. CROTON OIL. CASTOR SEEDS. OIL OF TURPENTINE. OIL OF TAR. MOULDY BREAD.

General Remarks.—The poisonous substances of an irritant nature which belong to the vegetable kingdom are very numerous as a class; but it will here be necessary to notice only those which have either caused death, or have given rise to accidental poisoning.

ALOES. COLOCYNTH. GAMBOGE. JALAP. SCAMMONY.

These different substances, which are used in small doses as medicines, are liable, when taken in large quantities, to give rise to vomiting, purging, and other symptoms of irritation. Colocynth has occasioned death in several instances: in one case a teaspoonful and a half of colocynth powder destroyed life; and one drachm of gamboge, a medicine much used by quacks, has proved fatal to man. (Traill's Outlines, 150.) Aloes and colocynth mixed are said to be the basis of a certain quack medicine sold under the name of Morison's Pills. These have proved fatal in many instances from the exhaustion produced by excessive purging, owing to the large quantity of these pills taken in frequently repeated doses. Our knowledge of the symptoms and post-mortem appearances produced by these irritants is, indeed, chiefly derived from the cases which have proved fatal under this pernicious treatment. In the seventeenth volume of the Medical Gazette will be found four cases of this description. The most prominent symptom is excessive diarrhœa, with the discharge of large quantities of mucus; the individual becomes emaciated, and slowly sinks. In some instances the symptoms are those of inflammation and ulceration of the bowels. In 1836, a man was convicted of having caused the death of a person by the administration of these pills: in this instance the death of the deceased was clearly due to the medicine; and on inspection, the stomach was found inflamed and ulcerated; the mucous membrane of the small intestines was inflamed and softened, and there was the appearance of effused lymph upon it. An ingenious attempt was made in the defence to draw a statement from the medical witness that the good effects of some medicines invariably increased in proportion to the quantities taken. This anti-homœopathic proposition was, however, very properly rejected. The same remarks apply to Holloway's Pills, although these are of a more innocent description. The principal ingredient in them is aloes. In all cases it must be remembered that these drastic purgatives may cause serious symptoms or even death when administered to infants, or to persons debilitated by age or disease; and it is not necessary that the dose should be very large for

fatal effects to follow. The question here will be, whether the medicine caused death, or whether it simply accelerated it.

Hiera picra appears to be a popular aloetic compound, and one death is recorded to have been produced by this in 1837-8. In another instance death was caused by taking aloes in nitric acid, in which case the mineral acid was most probably the destructive agent. A singular case occurred in Germany a few years since, wherein a medico-legal question was raised respecting the poisonous properties of aloes. A woman, aged forty-three, not labouring under any apparent disease, swallowed two drachms of powdered aloes in coffee. Violent diarrhœa supervened, and she died the following morning, twelve hours after having taken the medicine. On inspection, the stomach was found partially, and the small intestines extensively, inflamed. There were no other particular appearances to account for death, and this was referred to the effect of the aloes.

Savin. (Juniperus Sabina.)

This is a well known plant, the leaves or tops of which contain an irritant poison in the form of an acrid volatile oil of a remarkable odour. They exert an irritant action, both in the state of infusion and powder. They yield by distillation a light yellow oil, on which the irritant properties of the plant depend. The powder is sometimes used in medicine in a dose of from five to twenty grains. The substance is not often taken as a poison for the specific purpose of destroying life; but this is occasionally an indirect result of its use, as a popular means of procuring abortion. In this way it appears to have proved fatal in one case in 1837-8. From the little that is known of its effects, it acts by producing violent pain in the abdomen, vomiting, and strangury. After death, the œsophagus, stomach and viscera, with the kidneys, have been found either much inflamed or congested. It has no action as an abortive, except like other irritants, by causing a violent shock to the system, under which the uterus may expel its contents. Such a result can never be obtained without placing in jeopardy the life of the woman; and where abortion follows, she generally falls a victim. On the other hand, the female may be killed by the poison without abortion ensuing. In May, 1845, I met with a case in which death had been caused by savin-powder,—abortion having first taken place. Eight ounces of green liquid were found in the stomach, which, with the œsophagus and the small intestines, was highly inflamed. The poison was easily identified by placing some of the minute portions of the leaves found in the stomach under a powerful microscope. (Med. Gaz. xxxvi. 646.) [Several cases are on record in this country of the fatal use of oil of tansy (tanacetum vulgare) for the purpose of producing abortion. In one instance a teaspoonful of this oil was taken by mistake, instead of the essence, as an emmenagogue, by a girl who was ignorant of its poisonous effects. She immediately complained of vertigo, and became insensible in about ten minutes. Convulsions supervened directly, with frothing at the mouth, labour in breathing, irregular pulse, and death in one hour after taking the oil. Am. Jour. Med. Sci., July, 1852, 279.—H.]

Croton Oil.

This is an oil extracted from the seeds of the croton tiglium. It is a powerful drastic purgative, producing, in a large dose, severe purging, collapse, and death. A case occurred in Paris in 1839, where a man swallowed by mistake two drachms and a half of croton oil. In three-quarters of an hour the surface was cold and clammy, the pulse imperceptible, respiration difficult, and the extremities and face were as blue as in the collapsed stage of cholera. In an hour and a half purging set in; the stools were passed involuntarily, and the abdomen was very sensitive to the touch. The patient complained of a burning pain in the course of the œsophagus. He died in four hours after swallowing the poison. There was no marked change in the mucous membrane of the stomach!

In June, 1850, I was consulted in a case in which it was supposed that this liquid had been employed for the purpose of destroying life; and although arsenic was found in the stomach, it became a question to determine what was the fatal dose of this oil. In this instance, sixty drops had been sold, mixed with two ounces of linseed oil. This is considered a proper dose for cattle. In man, a dose of from fifteen to twenty drops of the *pure* oil, might give rise to excessive purging, and thus cause death by exhaustion. The cases recorded of its fatal operation are very few, and do not enable us to solve this question from observed facts. According to Landsberg, as quoted by Christison, (Dispensatory, p. 382) thirty drops of the oil have killed a dog, and Dr. Christison has known four grains of the oil to produce an alarming degree of purging. It is frequently adulterated with Castor oil and other substances, and these adulterations must of course influence the dose required to act fatally. In a recent volume of the Medical Gazette, there is a report of a case in which a woman died from the effects of an embrocation containing croton oil—with other drugs. A teaspoonful was incautiously given to her; she immediately complained of a hot burning sensation in her throat. She was an aged person, and died in convulsions in three days. (Med. Gaz. vol. xliii. page 41.)

Castor Seeds.

Of castor oil itself nothing need be said. It is not commonly known that the seeds from which this oil is extracted contain in the embryo a very active poison, and that a few of them are sufficient to produce violent purging and death. The following is an instance of poisoning by these seeds,—the only one with which I have met. The deceased, aged eighteen, was the sister of a gentleman who was at the time attending my lectures at Guy's Hospital.

The deceased, it appears, ate about twenty castor-oil seeds; one of her sisters ate four or five, and another two. This was on a Wednesday evening. In the night they were all taken ill. About five hours after the seeds were eaten, the deceased felt faint and sick; vomiting and purging came on, and continued through the night. On the following morning, she appeared like one affected with malignant cholera. The skin was cold and dark-coloured, the features contracted, and the breath cold; the pulse was small and wiry; there was restlessness, thirst, pain in the abdomen, and she lay in a sort of drowsy, half conscious state. Whatever liquid was taken was immediately rejected, and the matters passed by stool consisted chiefly of a serous fluid, with blood. She died in five days without rallying; the two other sisters recovered. On inspection, a very large portion of the mucous membrane of the stomach was found abraded and softened in the course of the great curvature. There was general vascularity of the organ, and the abraded portion presented the appearance of a granulating surface of a pale rose colour; it was covered by a considerable quantity of slimy mucus. The small intestines were inflamed, and the inner surface of them was abraded. The effects produced on the sisters who recovered bear out the statement of Dr. Christison, that two or three of the seeds will operate as a violent cathartic. [We have known the castor-bean, as it is called in this country, to be eaten freely with impunity, and in other cases to produce the most violent and even fatal emeto-catharsis. The oil itself is sometimes a powerful irritant. Devergie notices two cases where death followed in three hours after the administration of an ounce of this oil.—H.]

The Elder. (Sambucus nigra.)

Dr. Christison states that the *leaves* and *flowers* of the common elder act as an irritant poison, having caused in a boy severe inflammation of the bowels, which lasted for eight days. (Ed. Med. and Surg. Jour. xxxiii. 73.) The berries of this tree do not appear to possess, in the ripe state, any noxious properties. The

following case of poisoning by the expressed juice of the *roots*, is reported in the Med. Gaz. xxxv. 96.

A weakly woman, fifty-four years of age, who had been sick all day, and thrown up a quantity of greenish matter, which she regarded as bile, was persuaded by her husband to take two tablespoonfuls of the juice of the fresh elder root, which he himself had dug up, shaved down, and pressed. The woman soon after complained of severe pain in the abdomen. She was ordered some infusion of senna, but did not take it, as the bowels began almost immediately to act copiously. Next day the symptoms were those of enteritis, which proved fatal.

Oil of Turpentine.

The few cases in which this liquid has produced any noxious symptoms, have occurred among children. From these it appears to have rather the effects of a narcotic than an irritant poison. In a dose of three drachms it produced intoxication. A dose of a tablespoonful caused in a child aged eighteen months, symptoms bearing a strong resemblance to those occasioned by an overdose of opium, although they were not so rapidly manifested. (See case by Mr. Johnson, Med. Times, Oct. 11, 1851, page 380.) In three hours there was complete insensibility; stertorous breathing, strongly contracted pupils, rapid and weak pulse,—coldness of surface, pallor of the countenance,—general relaxation of the muscles, with occasional convulsive movements. In no instance yet recorded has this oil caused death. A case of recovery in an infant that had swallowed four ounces, is recorded in another work. (On Poisons, 528.)

Oil of Tar.

This is a powerful vegetable irritant. In 1832, about ten drachms of it caused the death of a gentleman, to whom it had been sent by mistake for a black draught. The party who sent it was tried for manslaughter, but acquitted.

Mouldy Bread.

There is a common article of food, namely, *bread*, upon the noxious effects of which some observations have been lately made by toxicologists. In the Ann. d'Hygiène, 1843, pp. 35 and 347, will be found communications on this subject from MM. Guérard, Chevallier, and Gaultier de Claubry. The changes which take place in the decomposition of flour and bread, and the production of various kinds of *mouldiness*, are here investigated, together with the effects of such bread upon the animal system. It would appear that in some parts of France the peasantry manifest no repugnance to the eating of *mouldy bread*, and that in many instances the practice appears to be attended with no ill effects. The nature of the mould produced, however, is subject to great variation, and it is not improbable, as M. Chevallier suggests, that in some cases a poisonous principle is actually developed. In two instances of children, who had partaken of mouldy rye-bread, symptoms resembling those of irritant poisoning supervened. The countenance was red and swollen; the tongue dry; the pulse quick; there were violent colics, with pain in the head, and intense thirst. Vomiting and purging supervened with a state of collapse, but the children eventually recovered. These symptoms were ascribed to the production of "*mucor mucedo*" in the bread. In 1829, alarming effects having followed from the use of a certain kind of bread in Paris, M. Barruel was called upon to determine whether any irritant poison had or had not become accidentally intermixed with it. The bread was simply in a mouldy state; there was no trace of poison. It is unnecessary to enter further into this subject; the facts adduced, together with experiments performed on animals, show that bread, in a state of mouldiness, may not only produce symptoms of poisoning, but actually cause death; and as it is impossible to distinguish the noxious from the innoxious kind of mould, the use of all bread in such a condition should be avoided.

Even *fresh bread* may occasionally seriously affect the body. The *brown bread* of London has been known to produce vertigo, lethargy, and other unpleasant symptoms, indicative of an affection of the brain and nervous system. This has been ascribed, with some probability, to the "*lolium temulentum*" (darnel) becoming accidentally mixed with the corn. In one instance in which Darnel seeds were mixed in the proportion of one tenth part with rye, the persons partaking of the bread suffered from vertigo, headache, nausea, vomiting, deafness, and cramps. (Med. Gaz., xlv. 872.) Rye-bread is not much used in this country, but the accidental presence of the *ergot* might here, in some cases, account for the symptoms which have been observed. (See Ann. d'Hyg. 1834, ii. 179; 1835, ii. 240; 1843, i. 41, 347; Henke, Zeitschrift der S. A. 1842, ii. 185; 1844, i. 286, ii. 215.)

Other vegetable irritants might be enumerated, but these are the principal which have given rise to medico-legal inquiries. The treatment of such cases must depend on the nature of the symptoms; the main object should always be to remove the poison either from the stomach or bowels, with as little delay as possible. The nature of the poison is commonly apparent from the circumstances; for these cases, if we except the substance Savin, which is sometimes criminally administered, are generally the result of accident. These vegetable poisons are beyond the reach of chemical processes: they are only to be recognised either by their physical properties, or by the botanical characters of the berries, seeds, or leaves.

ANIMAL IRRITANTS.

CHAPTER XV.

CANTHARIDES OR SPANISH FLY—SYMPTOMS AND EFFECTS—ANALYSIS. POISONOUS FOOD—FISH—MUSSELS—SALMON—CHEESE—SAUSAGES—DISEASED FLESH OF ANIMALS.

CANTHARIDES. (SPANISH FLY.)

Symptoms and effects.—This poison has been frequently administered, either in the state of powder or tincture, for the purpose of exciting aphrodisiac propensities, or of procuring abortion. When taken in *powder*, in the dose of one or two drachms, it gives rise to the following symptoms:—A burning sensation in the throat, with great difficulty of swallowing—violent pain in the abdomen, with nausea, and vomiting of bloody mucus; there is also great thirst and dryness of the fauces, but in a few cases observed by Mr. Maxwell, salivation was a prominent symptom. As the case proceeds, pain is commonly experienced in the loins, and there is incessant desire to void urine, but only a small quantity of blood or bloody urine is passed at each effort. The abdominal pain becomes of the most violent griping kind. Diarrhœa supervenes, but this is not always observed;—the matters discharged from the bowels are mixed with blood and mucus, and there is often tenesmus, (straining.) In these, as well as in the vomited liquids, shining green particles may be commonly seen on examination, whereby the nature of the poison taken is at once indicated. After a time, there is often severe priapism, and the genital organs are swollen and inflamed both in the male and female. In one instance, observed by Dr. Pereira, abortion was induced, probably owing to the excitement of the uterus, from the severe affection of the bladder; for there is no proof that this substance acts directly on the uterus to induce abortion. With respect to the aphrodisiac propensities caused by cantharides, these can seldom be excited in either sex, except when the substance is administered in a dose which would seriously endanger life. When the case proves fatal, death is usually preceded by syncope, vertigo, and convulsions. The *tincture* of cantharides produces similar symptoms: they are, however, more speedily induced, and the burning sensation and constriction of the throat and stomach are more strongly marked: it is often so severe as to render it impossible for the individual to swallow; and the act of swallowing gives rise to the most excruciating pain in the throat and abdomen.

Post-mortem appearances.—In one well-marked case of poisoning by this substance, the whole of the alimentary canal, from the mouth downwards, was in a state of inflammation, as well as the ureters, kidneys, and internal organs of generation. The mouth and tongue seemed to be deprived of their mucous membrane. In another instance, where an ounce of the tincture was swallowed, and death did not occur for fourteen days, the mucous membrane of the stomach was not inflamed, but it was pulpy, and easily detached. The kidneys were, how-

ever, inflamed. The brain has been found congested, and ulceration of the bladder is said to have been met with. There are very few fatal cases reported, in which the appearances have been accurately noted; indeed, the greater number of those who have taken this poison have recovered. In a case which occurred to Mr. Saunders, death took place in about twenty-four hours. The deceased must have taken the greater part of half an ounce of cantharides in powder. This was followed by the usual symptoms. On inspection, the vessels of the brain were filled with dark-coloured blood, and the ventricles were distended with serum. Both lungs were highly engorged with dark-coloured blood. The gullet was partially inflamed, and there were patches of inflammation on the mucous coat of the stomach, which had become detached in several places. The same inflammatory appearance existed in the small intestines, in the folds of which the powder of cantharides was abundantly seen. The vessels were distended, and the liver was engorged with dark blood. The gall-bladder was much distended with bile, and none of this secretion appeared to have passed into the bowels. The spleen and kidneys were highly congested: the ureters were inflamed; the bladder contracted and empty, and its internal surface pale. The glittering of the particles of cantharides in the viscera during this inspection by candlelight was very remarkable. (Medical Times, Feb. 3, 1849, p. 287.) Cantharides have no local action of a chemical nature. The poison is a pure *irritant*, and the effects observed are entirely due to irritation and inflammation.

The *quantity* of this poison required to produce serious effects, or to destroy life, has been a frequent subject of medico-legal inquiry. Dr. Thomson represents the medicinal dose of the powder to be from one to three grains. On a late criminal investigation, one medical witness stated that one grain was the maximum dose, but this is an under-statement; according to Thomson it is *three* grains. The dose of the London Pharmacopœial tincture is from ten minims gradually increased to one fluid-drachm,—of the powder, from *one to two grains*. (Pereira, Mat. Med. ii. 1846.) Doses above this, whether of the powder or of the tincture, are likely to be injurious, and to give rise to symptoms of poisoning. On a trial which took place at Aberdeen, in 1825, it appeared that a drachm of the powder had been administered: severe symptoms followed, but the person recovered. Dr. Dyce, the medical witness, said he had given ten grains of the powder at a dose as a medicine. In three cases, observed by Mr. Maxwell, a drachm of the powder mixed with six ounces of rum, was taken by each person; they were robust, healthy negroes,—they suffered severely, but recovered in about ten days: in these cases, irritation of the urinary organs did not appear until after the men had been bled. The *smallest quantity* of powder which has been known to destroy life was in the case of a young female, quoted by Orfila,—the quantity taken was estimated at *twenty-four grains* in two doses. She died in four days; but as abortion preceded death, it is difficult to say how far this may have been concerned in accelerating that event. Her intellect was clear until the last. In one instance a man recovered after having taken twenty grains of the powder, (Ed. Med. and Surg. Journ. Oct. 1844;) and in another, after having taken *two drachms*. (Med. Gaz. xlii. 873.)

An *ounce* of the tincture has been known to destroy life. It was taken by a boy, aged seventeen, and he died in fourteen days. This, I believe, is the smallest dose of the tincture which has killed. In the following instance a similar dose produced only serious symptoms. A woman, aged twenty-nine, swallowed an ounce of tincture of cantharides. Some time afterwards, there was severe pain in the abdomen, increased by pressure: it became swollen and tympanitic. She passed in the night a pint and a half of urine unmixed with blood. In two days, the pulse became feeble and scarcely perceptible:—there was delirium, with severe pain in the region of the kidneys and bladder: the urine was continually drawn off by a catheter. It was more than a fortnight before she was convalescent. (Med. Gaz. xxix. 63.) Four drachms, and even six drachms have been

taken; and although the usual symptoms followed, the parties did well. The last case was the subject of a trial at the Central Criminal Court, in September, 1836. Six drachms of the tincture were administered to a girl, aged seventeen: the medical witness was required to say whether half an ounce was sufficient to kill, as also what proportion of cantharides was contained in an ounce of the tincture: he said, five grains. One ounce of the tincture, (P. L.) is equivalent to six grains of the powder; but considering that the principle *cantharidine* is the substance on which the poisonous properties depend, it is very likely that the tincture varies in strength according to its mode of preparation. A case is quoted by Pereira, from Dr. Hosack (Mat. Med. ii. 1842,) in which it is said six ounces of the tincture were taken by a man without causing dangerous symptoms! This must have been an extraordinarily weak preparation; and probably the insects from which the tincture was made contained little or no cantharidine. The same writer mentions a case within his own knowledge, in which one ounce of the tincture caused serious symptoms.

Chemical Analysis.—Cantharidine is the vesicating, and at the same time the poisonous principle of the insect. It is a white solid crystallizable substance, insoluble in water; but soluble in ether, alcohol, the oils and caustic alkalies. Although water does not dissolve it in its pure state, it takes it up with other principles from the powdered insect; and thus an infusion of cantharides is poisonous. It is very volatile, and produces serious effects in the state of vapour. There are no chemical characters by which this principle can be safely identified, if we except its vesicating properties. Orfila has applied reagents to detect cantharidine in the tincture; but without success. It has been recommended to digest the suspected solid, or the liquid contents of the stomach evaporated to an extract, in successive quantities of ether,—to concentrate these ethereal solutions by slow evaporation, and then observe whether the concentrated liquid produces vesication or not; the medical jurist being expected in such cases to make himself the subject of experiment. In this way, Barruel discovered cantharides in some chocolate. (Ann. d'Hyg. 1835, i. 455.) This mode of testing is somewhat uncertain, unless the quantity of poison be large; and the affirmative evidence which it yields is better than the negative; since we can hardly infer the absence of the poison when we obtain no result. There is, however, no other mode of discovering cantharidine in solution, whether as tincture or infusion, than this. The difficulty of extracting this principle may be conceived, when it is stated that, according to Thierry's experiments, which are the most perfect, the quantity of cantharidine contained in the poison is only about the 250th part of the weight of the fly, so that it would require nearly half an ounce of the powder to yield one grain of cantharidine. The quantity required to produce vesication is unknown, but it is extremely small. Cantharides are most commonly taken in powder, and then we may easily recognise the poison by its physical characters. If the insect be entire, or only coarsely powdered, there can be no doubt of its nature. However finely reduced, the powder is observed to present, by reflected light, small golden-green or copper-coloured scales. These are perceptible to the eye, and are very distinct under a common lens, or by the aid of the microscope. It has been recommended to separate the particles of cantharides, by suspending the liquid or other contents of the stomach in warm water, when the insoluble powder will subside, and they may be collected and dried for examination. In an elaborate essay on this subject (Ann. d'Hyg. Oct. 1842,) M. Poumet recommends that the suspected liquids, mixed with alcohol, should be spread on sheets of glass, and allowed to evaporate spontaneously to dryness. The shining scales will then be seen, on examining, by reflected light, either one or both surfaces of the glass. This experiment answers very well. He has also found that the particles adhering to the mucous membrane of the stomach or intestines might be easily detected by inflating the viscus, and allowing it to become dry in the distended

state, taking care to attach to it a heavy weight, so that during the process of drying all the folds of the mucous membrane may disappear. On cutting the dried membrane, and opening it on a flat surface, the shining scales are perceptible. Physical evidence of this kind would not be of much avail for medico-legal purposes, unless there were concomitant evidence from symptoms and post-mortem appearances. In trials for administering, the analysis might be confined to the article administered; and the physical test is then applicable, since the powder is commonly given in very large quantity. There are many insects besides cantharides, which have wings of a golden green colour, and are not poisonous, yet such insects are not likely to be found in the state of powder in the human stomach. M. Poumet states that there are some cantharides which contain no cantharidine.

The evidence of the presence of cantharides, or of their having been taken, is necessary to support a criminal charge; for, however unambiguous the symptoms produced by this poison may appear to be in its peculiar effects upon the generative and urinary apparatus, the medical jurist should be aware that similar symptoms may proceed from disease. An important case of this kind has been reported by Dr. Hastings. (Med. Gaz. xii. 431.) A young lady was suddenly seized with vomiting, thirst, pain in the loins, strangury and considerable discharge of blood from the urethra: the generative organs were swollen and painful. She died in four days. She was governess in a family, and there was some suspicion that she had been poisoned by cantharides. The stomach and the kidneys were found inflamed, and the bladder also: this contained about two ounces of blood. There was no trace of poison; and, indeed, it was pretty certain, from the general evidence, that none could have been taken.

Particles of cantharides may be detected in the viscera long after interment. Orfila has detected them after a period of nine months, so that they do not seem to be affected by the decomposition of the body. [Several species of Lytta, possessing all the properties of cantharides, are to be found in this country. An account of them may be found in the Phila. Journ. of Pharm. 776.—H.]

Poisonous Food.

Certain kinds of animal food are found to produce, occasionally, symptoms resembling those of irritant poisoning. In some cases this poisonous effect appears to be due to idiosyncrasy; for only one person out of several may be affected. These cases are of some importance to the medical jurist, since they are very likely to give rise to unfounded charges of criminal poisoning. In the absence of any demonstrable poison, we must test the question of idiosyncrasy by observing whether more than one person is affected, and whether the same kind of food, given to animals, produces symptoms of poisoning. If, with this latter condition, several persons be affected simultaneously, we cannot refer the effects to idiosyncrasy; they are most probably due to the presence of an animal poison. Among the articles of food which have given rise to symptoms of poisoning, may be mentioned,—

Poisonous Fish. Mussels. Salmon.—Of all the varieties of shell-fish, none have so frequently given rise to accidents as the common mussel. The symptoms which it produces are, uneasiness and sense of weight in the stomach, sensation of numbness in the extremities, heat and constriction in the mouth and throat; thirst, rigors, difficulty of breathing, cramps in the legs, swelling and inflammation of the eyelids, with a profuse secretion of tears, and heat and itching of the skin, followed by an eruption resembling nettle-rash. The symptoms are sometimes accompanied by vomiting, colic, and purging. They may occur within ten minutes or a quarter of an hour; but their appearance has been delayed for twenty-four hours. There is generally great debility. These symptoms have proceeded from the eating of not more than ten or twelve mussels. Two cases, reported by Christison, proved fatal, the one in three, and the other

in about seven hours. In general, however, especially where there is free vomiting, the patients recover. In the inspection of the two above-named fatal cases, no appearance was found to account for death. The treatment consists in the free exhibition of emetics. A case in which two mussels produced in a boy aged ten, very alarming symptoms, followed by an eruption resembling scarlatina and nettle-rash, will be found elsewhere reported. (Guy's Hosp. Reports, Oct. 1850, 218.)

The poisonous action of mussels can neither be referred to putrefaction nor disease; nor in all cases to idiosyncrasy, since sometimes those mussels only have been poisonous which have been taken from a particular spot: all persons who partook of them suffered, and a dog was killed to which some of them were given. From a case which occurred to M. Bouchardat, it would appear that copper is sometimes present, and may be the cause of the poisonous effects. Two women were poisoned by mussels, and he found on analysis sufficient copper in the fish to account for the symptoms of irritation from which they suffered. (Ann. d'Hyg. 1837, i. 358.) Copper is not, however, present in all cases, and it is therefore probable that there is in some, if not in all instances, an *animal poison* present in the fish. *Oysters* and *Periwinkles* have occasionally given rise to similar symptoms. *Salmon*, sold in the state of pickled salmon, or even *Herrings* salted, may also act as irritants: this may be due to the fish being partially decayed before it is used. In 1834, two persons at Maidstone lost their lives from eating salmon of this description.

Cheese. Sausages.—These articles of food have frequently given rise to symptoms of poisoning in Germany, but there is, I believe, no instance of their having proved fatal in England. The symptoms produced by cheese have been those of irritant poisoning. The nature of the poison is unknown. In some cases the irritant property is undoubtedly due to a putrefied state of the curd. Again, it has been supposed that the poison is occasionally derived from certain vegetables on which the cows feed. The symptoms caused by the sausage-poison are very slow in appearing,—sometimes two, three, or four days elapse before they manifest themselves: they partake of the narcotico-irritant character. This poison is of a very formidable kind. In the Medical Gazette for Nov. 1842, there is an account of the cases of three persons, who had died from the effects of liver-sausages, which had been made from an apparently healthy pig, slaughtered only a week before. The inspection threw no light on the cause of death. The poisonous effect is supposed to depend on a *partial* decomposition of the fatty parts of the sausages. It is said, that when extremely putrefied, they possess no poisonous properties!

Pork. Bacon.—These common articles of food occasionally give rise to symptoms so closely resembling those of irritant poisoning, as to be easily mistaken for them. In some cases, the effect appears to be due to idiosyncrasy; but in others it can only be explained by supposing the food to have a directly poisonous action. The noxious effects of pork have been particularly shown by the cases published by Dr. MacDivitt. (Ed. Med. and Surg. Jour. Oct. 1836.)

There is no doubt that *epizootic disease* may be a frequent cause of rendering animal food poisonous. *Partial decay* may also render unwholesome and injurious the flesh of the most healthy animal. What the nature of the poison is, we are quite unable to determine. Liebig imagines that it is owing to the production of a fermenting principle, and that it operates fatally by producing a kind of fermentation in the animal body. It has been said that the symptoms of irritant poisoning produced by animal food, seldom appear until five or six hours after the meal. This may be generally true, but in certain instances it has undoubtedly happened that the symptoms came on in from a quarter to half an hour after the noxious food was taken.

Much of the game and butcher's meat sold to the poor in this metropolis is in a state of decay, and quite unfit for human food. In January, 1851, the family

of a surgeon near London were all affected with symptoms resembling irritant poisoning, after having partaken of a hare which had been stewed in a clean earthen vessel. The surgeon informed me that on the second day, his wife was seized with vomiting and purging, giddiness, heat in the throat, and general numbness, with semi-inflamed eyes. Other members of the family vomited, and in the course of a few days the symptoms disappeared. I examined the vomited matter, and found it to consist of portions of the hare, partially digested, but in a state of putrefaction, so that there was abundant evidence of sulphuretted hydrogen in the liquid. There was no mineral poison of any kind, although the symptoms, it will be observed, were rather like those occasioned by arsenic. It had been remarked by the family, that a silver spoon which had been used in serving out this unwholesome food, was turned of a brown colour, no doubt from the chemical action of sulphuretted hydrogen; and this may be taken as a good domestic test of the putrefied condition of such food. Nature generally applies an appropriate remedy, in the fact that the food itself produces copious vomiting and purging.

Cases of this kind must be distinguished from those in which *poisoned game* is sold to the public. The game may be quite free from putrefaction, but noxious from the poisoned grain which may have caused death. It is a very common practice to steep grain in a solution of arsenic previous to sowing, and pheasants, partridges, and other birds, may be accidentally destroyed by eating the grain. In some instances, grouse and other game are maliciously destroyed by corn saturated with arsenic being laid in the localities where the birds abound. There is no law to prevent the sale of the poisoned game by poulterers, and there is no precaution which can be taken, except by observing whether the birds have been shot. (See the work On Poisons, p. 164; also on this subject, a letter by Dr. Fuller, Med. Gaz. xlii. 1036.)

[The most frequent cases of poisoning from animal substances in the United States, have occurred from the pheasant. (*Tetrao umbellus.*) This bird, during the winter season, has sometimes caused dangerous symptoms in persons who have eaten it. These have generally been attributed to the fact of the bird having fed upon the leaves and buds of the Laurel (*Kalmia,*) and many facts have been adduced which are considered as corroborating this opinion, the most striking of which is the occurrence of the leaves of the plant in the crops of the birds. Notwithstanding this almost universal belief, Dr. Griffith, from whom we quote, is by no means satisfied with this explanation, but is inclined to attribute it to some change in the flesh analogous to that noticed above as taking place in other meats, since the symptoms are almost identical, and these cases are rare, whilst nearly all these birds feed on the laurel, when the ground is covered with snow, and other food cannot be readily obtained.

We have known cases also of serious irritation of the kidneys and bladder, from eating game which had been rendered poisonous by feeding on the potato fly, a species of Lytta.

But by far the most interesting subject connected with animal poisons in this country is that of "milk sickness," as it is termed, a disease with symptoms resembling those caused by the animal poisons, which has been not unfrequent and oftentimes fatal, in some of the western States, and is almost universally attributed to poison communicated to the milk from some noxious plant eaten by the cow. It is also stated that the flesh of the animal becomes equally deleterious with the milk. The accounts of this disease, as Dr. Griffith justly says, are by no means satisfactory, nor has it been shown that any plants fed on by the cow are capable of thus rendering the secretions and flesh of the animal so highly noxious. From all the evidence on the subject, he considers it more probable that it is rather attributable to some peculiar disease of the cattle, more especially as it is known that murrain will thus render the flesh of animals poisonous to man. See *Am. Med. Recorder*, vi. 257; *Am. Journ. Med. Science*, 1841; *New York Journ. Med.* 1843; also Taylor on Poisons, 441, 456.—H.]

NARCOTIC POISONS.

CHAPTER XVI.

NARCOTIC POISONS—OPIUM—SYMPTOMS—PERIOD OF COMMENCEMENT—POST-MORTEM APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—DEATH FROM SMALL, AND RECOVERY FROM LARGE DOSES—ITS ACTION ON INFANTS—PERIOD AT WHICH DEATH TAKES PLACE—POISONING BY POPPIES—GODFREY'S CORDIAL—DALBY'S CARMINATIVE—PARREGORIC ELIXIR—DOVER'S POWDER—MORPHIA AND ITS SALTS—BLACK DROP—SEDATIVE SOLUTION—TESTS FOR MORPHIA AND MECONIC ACID—PROCESS FOR DETECTING OPIUM IN ORGANIC MIXTURES.

Opium.

Symptoms.—The symptoms which manifest themselves when a large dose of opium or its tincture has been taken, are in general of a uniform character. They consist in giddiness, drowsiness, strong tendency to sleep, stupor, succeeded by perfect insensibility, the person lying motionless, with the eyes closed as if in a sound sleep. In this stage he may be easily roused by a loud noise, and made to answer a question; but he speedily relapses into stupor. In a later stage, when coma has supervened with stertorous breathing, it will be difficult, if not impossible, to rouse him. The pulse is at first small, quick, and irregular, the respiration hurried, and the skin warm and bathed in perspiration —sometimes livid: but when the individual becomes comatose, the breathing is slow and stertorous: the pulse slow and full. The skin is occasionally cold and pallid. The pupils are sometimes contracted, at others dilated. From cases which I have been able to collect, contraction of the pupils is much more frequent than dilatation. In a case referred to me in 1846, one pupil was contracted and the other dilated. They are commonly insensible to light. The expression of the countenance is placid, pale, and ghastly: the eyes are heavy, and the lips are livid. Sometimes there is vomiting, or even diarrhœa; and if vomiting takes place freely before stupor sets in, there is great hope of recovery. This symptom is chiefly observed when a large dose of opium has been taken; and it may then be, perhaps, ascribed to the mechanical effect of the poison on the stomach. The odour of opium is occasionally perceptible in the breath. Nausea and vomiting, with headache, loss of appetite and lassitude, often follow on recovery. The muscles of the limbs feel flabby and relaxed, the lower jaw drops, the pulse becomes feeble and imperceptible, the sphincters are in a state of relaxation, the temperature of the body is low, there is a loud mucous rattle in breathing, and convulsions are sometimes observed before death: these are more commonly met with in children than in adults. One of the marked effects of this poison is to suspend all the secretions except that of the skin. During the lethargic state, the skin, although cold, is often copiously bathed in perspiration. It is a question yet to be determined, whether this may not be the medium by which the poison is principally eliminated.

These symptoms usually *commence* in from *half an hour* to *an hour* after the poison has been swallowed. Sometimes they come on in a few minutes, especially in children; and at others their appearance is protracted for a long period. In a case reported by Dr. Skae, the individual was found totally insensible in *fifteen minutes*. As we might expect, from the facts connected with the absorption of poisons, when the drug is taken in the *solid* state, the symptoms are commonly more slow in appearing, than when it is *dissolved* in alcohol.

Post-mortem appearances.—In a case which proved fatal in fifteen hours, examined at Guy's Hospital a few years since, the vessels of the head were found unusually turgid throughout. On the surface of the anterior part of the left hemisphere there was an ecchymosis, apparently produced by the effusion of a few drops of blood. There were numerous bloody points on the cut surface of the brain:—there was no serum collected in the ventricles. The stomach was quite healthy. Fluidity of the blood is mentioned as a common appearance in cases of poisoning by opium. There is also engorgement of the lungs; most frequently, according to Dr. Christison, in those cases which have been preceded by convulsions. (Op. cit. 732.) Among the external appearances there is often great lividity of the skin. This may be taken as a general statement of the post-mortem appearances in poisoning by opium. Extravasation of blood on the brain is rarely seen;—serous effusion in the ventricles, or between the membranes, is much more common. The stomach is so seldom found otherwise than in a healthy state, that the inflammatory redness said to have been occasionally met with, may be regarded as probably due to accidental causes. When tincture of opium has been taken and retained on the stomach, increased vascularity in the mucous membrane may occasionally be produced by the alcohol alone.

In a case of poisoning by a large dose of tincture of opium, Dr. Sharkey found the following appearances twelve hours after death:—The body warm and rigid; the stomach healthy, containing a quantity of a gruel-like fluid, without any smell of opium. The intestinal canal and all the other viscera were healthy. The veins of the scalp, as well as of the dura mater and sinuses, were gorged with blood; but there was no effusion in any part of the brain. The contents of the stomach yielded no trace of morphia or meconic acid, but there was no doubt that death had been caused by opium, taken the previous night. (Med. Gaz. xxxvii. 235.)

This description of the appearances refers to the action of large doses on adults. In a case which I had to investigate a few years since, a child aged fourteen months was killed in eighteen hours, from the effects of a dose of infusion of opium, equivalent to from three to five grains of the powder. The inspection of the body was made about twenty-four hours after death. It was not emaciated; and, externally, there were no particular appearances, excepting a few livid spots on the skin of the abdomen, back, and genitals, as also on the upper part of the thighs, sides, and back of the neck. The eyelids were open; the eyes sunk into the orbits, and their transparency gone: the child, it seems, had died with its eyes prominent and open. The pupils appeared contracted, but the condition of the iris was not particularly noticed during life. The viscera of the chest were perfectly healthy; there was no mark of effusion, or of any organic disease. The right cavities of the heart were congested, and the lining membrane of the organ was observed to be somewhat opalescent. The viscera of the abdomen were also healthy, except the kidneys, the cortical structure of which had undergone some change from disease, although to a very slight extent. It had evidently had no influence on the illness and death of the child. The peritoneum presented, in some parts, patches of a milky whiteness; but there was no appearance of inflammation or effusion. The stomach was perfectly healthy; the mucous membrane was raised into numerous rugæ, but there was no trace of inflammation or disease in any part. The cavity of the organ contained about a

teaspoonful of a white viscid liquid, apparently consisting of milk and mucus in a semi-digested state. There was no farinaceous or any other food present, and no smell of opium; nor was the slightest trace of morphia or meconic acid detected in it on analysis, although the child had not vomited, but had remained throughout in a state of insensibility. The intestines were found quite healthy. On opening the duodenum and jejunum a small quantity of liquid, similar to that contained in the stomach, was observed: this was also collected and set aside for analysis. In the cranium, the blood-vessels of the brain were found much congested; but there was no effusion or extravasation of blood or serum. In all other respects, the brain presented its usual healthy characters.

From this account of the post-mortem appearances it will be seen that there is nothing but turgescence of the vessels of the brain, which can be looked upon as indicative of poisoning by opium, and even this is not always present. This condition of the brain, however, if it exist, can furnish no evidence of poisoning, when taken alone, since it is so frequently found, as a result of morbid causes, in otherwise healthy subjects. The occasionally anomalous nature of the symptoms and post-mortem appearances in poisoning by opium, is well shown in a case communicated to me in November, 1850, by Mr. Walter Clegg, formerly a pupil of mine, and now Deputy Coroner for the County of Lincoln. A man, æt. 56, in good health, swallowed by mistake in two pills from twenty-eight to thirty grains of the opium of commerce. This was at three o'clock in the morning, and he died rather suddenly at one o'clock in the day—*i. e. ten hours* after taking the drug. In about an hour he began to moan; there was twitching of the head and arms, and copious perspiration, with alteration of speech; but he retained his senses, was a little drowsy at intervals, and vomited occasionally. He dressed himself as usual in the morning, and complained of severe pain in his stomach. He was seen by a medical man about two hours before his death: there was no coma, contraction of the pupils, nor any other symptom of poisoning by opium. Even the vomited liquid had no smell of the drug. He walked in a trembling way. As it was not supposed that he could have swallowed opium, no emetic was given. After death, there was no turgescence of the vessels of the brain, or of its membranes, but there was such congestion at the greater end of the stomach as to lead to the supposition that irritant poison had been taken. No irritant poison was found, but there were distinct indications of opium. The poison appears in this case to have produced no effect on the brain, but to have exerted its influence chiefly on the nerves connected with speech and motion.

Quantity required to destroy life.—The medicinal *dose* of opium, in *extract* or *powder*, for a healthy adult, varies from half a grain to two grains. Five grains would be a very full dose. The medicinal dose of the *tincture* is from ten minims to one drachm,—as an average, from *thirty* to *forty minims*. The *smallest dose of solid opium* which has been known to prove fatal to an adult, was in a case reported by Dr. Sharkey, of Jersey. A man, aged 32, died very speedily in a convulsive fit, after having taken two pills, each containing about one grain and a quarter of extract of opium. This quantity is equivalent to *four grains* of crude opium. (Med. Gaz. xxxvii. 236.) The *smallest fatal dose of the tincture* in an adult, which I have found recorded, is *two drachms*. The case is reported by Dr. Skae. (Ed. Med. and Surg. Journ. July, 1840.) The patient was a robust man, aged fifty-six;—he swallowed the tincture at ten in the evening, and died under the usual symptoms the following morning; the case thus lasting only twelve hours. The quantity actually swallowed, however, appears to be involved in some doubt; for it is subsequently stated (p. 160) that *half an ounce* of laudanum may have been taken. Very large doses of the tincture have frequently been taken without proving fatal. I have elsewhere recorded a case in which five ounces of laudanum were taken without producing sleep, and the patient recovered. (Guy's Hosp. Reports, Oct. 1850, p. 220.)

Action of opium on infants.—As connected with this subject, it is important

for a medical jurist to bear in mind, that *infants* and young persons are liable to be killed by very *small doses of opium:* they appear to be peculiarly susceptible of the effects of this poison. Dr. Ramisch, of Prague, met with an instance of a child four months old, that was nearly killed by the administration of one grain of Dover's powder, containing only the tenth part of a grain of opium:—the child suffered from stupor and other alarming symptoms. The following case occurred in June, 1832. Four grains of Dover's powder (containing less than half a grain of opium) were given to a child four years and a half old. It soon became comatose, and died in seven hours. Death was referred to inflammation of the throat, and the jury returned the usual unmeaning verdict of "Died by the visitation of God;" but there was no doubt from the evidence, that death was caused by the opiate medicine. Dr. Kelso also met with an instance where a child, nine months old, was killed in nine hours by four drops (minims?) of laudanum, equal to only *one-fifth part of a grain* of opium: it was much convulsed before death. A case is referred to in a late number of the Medical Gazette, in which two drops (minims?) of laudanum, equal to the *tenth part of a grain* of opium, killed an infant. The following is a more recent illustration of the fatal effects of a similar dose. A nurse gave to an infant, five days old, *two drops* (minims?) of laudanum, about three o'clock in the morning. Five hours afterwards, the child was found by the medical attendant in a state of complete narcotism. It was revived by a cold bath, but a relapse came on, and it died the same evening, about eighteen hours after the poison had been given to it. On inspection, the brain and abdominal viscera were found in a perfectly healthy state, and there was no smell of opium in the stomach. (Prov. Med. Journ. Oct. 28, 1846, p. 519.) The fatal dose here, as in the former case, was equal to the tenth part of a grain of opium, and to only an infinitesimal dose of morphia! In some instances infants have been found to have an astonishing power of recovery. Dr. Guy met with a case in which an infant of six months recovered after having had administered to it ten grains of Dover's powder, = one grain of opium (Lancet, June 8, 1850;) and Mr. Tubbs has informed me, that in a case which occurred in January, 1852, aninfant of nine months recovered under treatment from a dose of two teaspoonfuls of laudanum, given by mistake. This quantity left by evaporation four grains of an impure extract of opium.

Period at which death takes place.—It has been remarked, that most cases of poisoning by opium prove fatal in from about six to twelve hours. They who recover from the stupor, and survive longer than this period, generally do well; but from some cases which have occurred, it would seem that there may be a partial recovery, or a remission of the symptoms, and afterwards a relapse. The symptoms, however, generally progress steadily to a fatal termination, or the stupor suddenly disappears, vomiting ensues, and the individual recovers. Several instances are recorded of this poison having destroyed life in from seven to nine hours. One has occurred within my knowledge in which an adult died in five hours after taking the drug prescribed for him by a quack. Dr. Christison met with a case which could not have lasted above five, and another is mentioned by him which lasted only three hours. Dr. Beck quotes a case which proved fatal in two hours and a half. (Beck, Med. Jur. 873.) The most rapid case of death yet reported was that of a soldier who was accidentally poisoned, in September, 1846, in the Hospital of Val-de-Grâce. It appears that he swallowed by mistake about an ounce of laudanum, and died in convulsions in *three-quarters of an hour* afterwards. (Journal de Médecine, Oct. 1846, p. 475.) For a similar case, see Med. Gaz. xlv. 743. It is possible that the drug may even kill with greater rapidity than this; but as a medico-legal fact, we are at present entitled to state, that it has destroyed life within the short period above mentioned. On the other hand, the cases are sometimes much protracted. There are several instances of death in fifteen or seventeen hours. I have known one case fatal in twenty-two hours, and among those collected by Dr. Christison, the longest lasted twenty-four hours. (Op. cit. 712.)

Poisoning by Poppies.

The heads of the white poppy, grown in this country, have a narcotic action. They yield an inspissated extract called English opium, which, according to Mr. Hennell, contains five per cent. of morphia. The white poppy-heads, therefore, yield to water, in the form of decoction, a poisonous substance capable of acting deleteriously on children. Many cases of poisoning have occurred from the injudicious use of *Syrup of poppies*, which is nothing more than a sweetened decoction of the poppy-heads. This syrup is said to contain *one grain* of extract (opium) to *one ounce* (Thomson.) The common dose of it for an infant three or four months old, is half a drachm; for adults, two to four drachms. (Pereira, ii. 1769.) There is some reason to believe that what is often sold by many druggists for syrup of poppies as a soothing or cordial medicine for children, is nothing more than a mixture of tincture or infusion of opium with simple syrup: it is, therefore, a preparation of very variable strength. This may account for what appears to many persons inexplicable, namely, that an infant may be destroyed by a very small dose. In January, 1841, a child six months old is said to have died from the effects of less than half a teaspoonful of syrup of poppies bought at a retail druggist's. The narcotic symptoms were fully developed in three quarters of an hour. The syrup in this case probably contained tincture of opium. Seven children are reported to have lost their lives by this syrup in 1837-8. In one of these cases, a teaspoonful and a half was given. Stupor came on in half an hour, and the child died the following day. A teaspoonful has been known to prove fatal to a healthy child. (Pereira, ii. 1769.)

Godfrey's Cordial.

This is chiefly a mixture of infusion of sassafras, treacle, and tincture of opium. The quantity of tincture of opium, according to Dr. Paris, is about one drachm to six ounces of the mixture, or *half a grain of opium to one ounce;* but it is very probable that, like the so-called syrup of poppies, its strength is subject to great variation. A case has been reported, in which half a tea-spoonful, = 1-32nd part of a grain of opium, was alleged to have caused the death of an infant. In 1837-8, twelve children were admitted to have been killed by this mixture alone. The explanation of this is, that the medicine is given in large doses by very ignorant persons. [The U. S. Pharm. directs rather more than one grain of opium to the fluid ounce.]

Dalby's Carminative.

This is a compound of several essential oils and aromatic tinctures in peppermint water, with carbonate of magnesia and tincture of opium. According to Dr. Paris, there are *five minims* of the tincture, or one quarter of a grain of opium, to rather more than *two ounces* of this mixture, or *the one-eighth of a grain to an ounce.* The formula commonly given is—carbonate of magnesia two scruples, oil of peppermint one minim, of nutmegs two minims, of aniseed three minims, tincture of opium five minims, spirit of pennyroyal and tincture of assafœtida of each fifteen minims, tincture of castor and compound tincture of cardamoms of each thirty minims, and of peppermint water two ounces. According to this formula, tincture of opium forms the 1-211th part by measure, or one teaspoonful would contain the 1-64th part of a grain of opium. Like most of these quack-preparations, it probably varies in strength. An infant is reported to have been destroyed by *forty drops* of this nostrum—a quantity, according to the strength assigned, equivalent to more than *two minims* of the tincture, or one-tenth of a grain, of opium. Accidents frequently occur from its use, partly owing to ignorance, and partly to gross carelessness on the part of mothers and nurses.

Paregoric Elixir. Compound Tincture of Camphor.

This is a medicinal preparation of alcohol, opium, benzoic acid, oil of aniseed, and camphor. Opium is the active ingredient, and of this, the tincture contains rather less than *one grain* in every *half ounce* (nine grains to five ounces.)

In one case of poisoning by this tincture, a child aged seven months was killed by a tea-spoonful given in two doses at an interval of a day; *i. e.* by a quantity equal to one quarter of a grain of opium. (Pharmaceutical Journal, April, 1845.)

Dover's Powder. (Pulv. Ipecac. Comp.)

This is a preparation of opium, the effects of which on young children have been already adverted to. The proportion of opium is one-tenth part, or *one grain* in every *ten grains* of the powder. A child has been killed by four grains; therefore by a quantity containing about two-fifths of a grain of opium; but Dr. Guy has reported a case in which an infant of six months recovered, under active treatment, from a dose of *ten grains*. (Lancet, June 8, 1850.)

Morphia and its Salts.

Morphia and its saline combinations must be regarded as active poisons. The pure alkaloid is known from its salts by its great insolubility in water; and owing to this property some have regarded it as less poisonous. The acid secretions of the stomach would, however, dissolve it in sufficient quantity to produce very speedily dangerous effects. The two principal salts of morphia are the MURIATE and the ACETATE.

Symptoms.—They generally *commence* in from *five to twenty minutes* after the dose of poison has been swallowed; and they very closely resemble those observed in poisoning by opium. As a summary, it may be stated that they consist in dimness of sight, weakness and relaxation of the muscular system, tendency to sleep, stupor, loss of consciousness, coma, stertorous respiration, and more commonly than in poisoning by opium, there are convulsions. According to Orfila, in nineteen-twentieths of all cases, the pupils will be found strongly contracted, a statement which I believe to be correct: the few exceptional cases were those in which the dose was excessive, and the symptoms were unusually violent. The state of the pupils gave rise to great difference of opinion among the medical witnesses on the trial of Dr. Castaign. (Orfila, ii. 185; On Poisons, 615.) The condition of the pulse varies greatly. In some cases, there is great irritability with itching of the skin, and irritability of the bladder with difficulty of passing urine. Vomiting and diarrhœa have been met with in those instances in which the dose was large.

Post-mortem appearances.—The only post-mortem appearance which can be referred to the action of morphia, is fulness of the cerebral vessels, with occasionally serous effusion. These poisons have no local irritant action, and they, therefore, leave no marks of their operation in the stomach and bowels.

Black Drop.

This is a preparation of opium, in which the morphia is combined with acetic acid, and very little meconic acid is present. In the Black drop, according to Pereira, verjuice, the juice of the wild crab, is employed as a menstruum instead of vinegar. The Black drop is considered to have from three to four times the strength of the tincture of opium. The formula for this preparation will be found in Dr. Neligan's work, On Medicines, &c., p. 235. According to this, it is a compound of half a pound of opium to three pints of the expressed juice of the wild crab.

It resembles the *Acetum Opii*, and has more than twice the strength of laudanum. [The Black drop of the U. S. Pharm. contains about one grain of opium to from six and a half to seven minims.]

Sedative Solution.

This is an aqueous solution of opium with a little spirit and less meconic acid than the common tincture. (Pereira, ii. 1772.) It is considered to have three times the strength of tincture of opium; but there is so great a difference of opinion on this point, that Dr. Neligan represents it as being only of about the same strength as laudanum. (Medicines, &c., 236.) He states that it is composed of three ounces of extract of opium, six drachms of spirit, and as much distilled water as will make up two pints. It appears to be an energetic preparation. Mr. Streeter stated at the Westminster Medical Society, Dec. 1838, that he had known one drachm and a half of it prove fatal to a lunatic; and twenty minims of the solution destroyed the life of an old woman. A medical gentleman, lying dangerously ill from an attack of dysentery, took, by mistake, about seven drachms of Battley's Solution. Within five minutes, salt and water, with mustard, were administered, and twenty-four grains of sulphate of zinc. Vomiting ensued: the emetic was repeated, and with the same effect; the fluid evacuated at the second vomiting having the usual smell of opium. Half a drachm of ipecacuanha was afterwards given, to complete the emptying of the stomach. Notwithstanding this repeated vomiting, symptoms of narcotism presented themselves speedily, with contraction of the pupil, and very great drowsiness—rendering it necessary to remove him from bed in his very debilitated state, and keep him constantly moving, until about 9 P. M. (seventeen hours,) when vomiting came on spontaneously, and he was put to bed, and allowed to sleep. The original disease afterwards resumed its course (complicated by an attack of gastritis,) and at length terminated favourably; but the patient had no recollection whatever of what occurred for twenty-four hours after the administration of the emetics; and it appeared to his medical attendants that an excited state of the mind remained for some days afterwards. (Prov. Journ., Jan. 28, 1846, 42.) The recent melancholy death of Dr. Badeley, of Chelmsford, from a dose of this solution taken medicinally, furnishes an additional proof of the dangerous uncertainty in the strength of this preparation.

Chemical analysis. Opium.—There are no means of detecting opium itself, either in the solid or liquid state, except by its smell and other physical properties, or by exhibiting a portion of the suspected substance to animals, and observing the effects produced. The smell is said to be peculiar, but a similar smell is possessed by lactucarium, which contains neither meconic acid nor morphia. The *odour* is a good concomitant test of the presence of the drug, whether it be in a free state, or dissolved in alcohol or water, but it is not perceptible when the solution is much diluted. I found that half a grain of powdered opium, dissolved in half an ounce of water, lost its characteristic smell by a short exposure. The odour is decidedly volatile, and passes off when an opiate liquid is heated; it also escapes slowly at common temperatures. Again, it may be easily concealed by other odours, or the drug may undergo some change in the stomach during life which may destroy the odour. The analysis in cases of poisoning by opium is therefore limited to the detection of morphia and meconic acid.

Morphia.—Morphia is known by the following properties:—1. It crystallises in fine prisms, which are white and perfect, according to their degree of purity. 2. When heated on platina, the crystals melt, become dark-coloured, and burn like a resin with a yellow smoky flame, leaving a carbonaceous residue. If this experiment be performed in a small reduction-tube, it will be found by employing test-paper, or a mixture of arsenious acid and nitrate of silver, that ammonia is one of the products of decomposition. 3. It is scarcely soluble in cold water, requiring 1000 parts to dissolve it; it is soluble in one hundred parts of boiling water, and the hot solution has a faint alkaline reaction. By its insolubility in water it is readily known from its salts. It is not very soluble in ether, thus differing from narcotina; but it is dissolved by forty parts of cold, and rather

less than this quantity of boiling alcohol. It is soluble in oils and in the caustic alkalies (potash.) 4. It is easily dissolved by a very small quantity of all diluted acids, mineral and vegetable. 5. It has a bitter taste.

Tests.—In order to apply the chemical tests for morphia, the alkaloid may be dissolved in a few drops of a diluted acid, either the acetic or muriatic. If the muriate or the acetate of morphia be presented for analysis, it may be at once dissolved in a small quantity of boiling water. The best tests for this alkaloid are the following: 1. *Nitric acid.* This, when added to a moderately strong solution of a salt of morphia, produces slowly a deep orange-red colour. If added to the crystals of morphia or its salts, deutoxide of nitrogen is evolved:—the morphia becomes entirely dissolved, and the solution acquires instantly the deep red colour above described,—becoming, however, lighter by standing. In order that the effect should follow, the solution of morphia must not be too much diluted, and the acid must be added in pretty large quantity. The colour is rendered much lighter by boiling; therefore the test should never be added to a hot solution. 2. *Permuriate of iron* (sesquichloride,) or colourless persulphate. Either of these solutions when saturated and neutralized (by a small quantity of potash if necessary,) produces an inky-blue colour in a solution of morphia. If the quantity of morphia be small, or the test have a deep red or yellow tint, the colour is greenish. The blue colour is entirely destroyed by acids,—it is also destroyed by heat: thus the iron-test should never be employed with a very acid or a very hot solution of a salt of morphia. It should be observed that the blue given by the test in a solution of morphia, is entirely destroyed by nitric acid and replaced by the orange-red colour, so that the nitric acid will act through the iron-test, but not vice versâ. In this way two tests may be applied to one quantity of liquid. 3. *Iodic acid.* Morphia in the solid state or in solution decomposes this acid, taking part of its oxygen, and setting free iodine. In order to make this evident, the iodic acid should be first mixed with starch; and a part of this mixture only, added to the suspected solution,—part being reserved to allow of a comparison. If the iodic acid be added to the solution of morphia without starch, the liquid becomes brown and smells of iodine. When the quantity is very small, there is only a reddish or purple tint slowly produced:—when large, the dark-blue iodide of farina is formed in a few seconds. This colour being destroyed by heat, the test must not be added to a hot solution. This test succeeds equally well with morphia or its salts when unmixed with organic matter; but the analyst must remember, that the blue iodide of farina forms a colourless combination with a large quantity of starch: hence but little of this substance should be used, if the quantity of morphia be small. 4. *Sulphuric acid* and *chromate of potash.* When strong sulphuric acid is poured on pure morphia in a solid state, there is either no effect, or the alkaloid acquires a light pinkish colour. On adding to this a drop of chromate of potash, it immediately becomes green (from oxide of chrome,) and it retains this colour for some time. Other alkaloids are not thus affected. Narcotina is turned of a bright yellow by sulphuric acid; therefore, although it becomes green with chromate of potash, it could not be mistaken for morphia; besides, the green rapidly passes to a dingy brown colour.

Meconic acid.—This is a solid crystalline acid, seen commmonly in scaly crystals of a reddish colour. It is combined with morphia in opium, of which, according to Mulder, it forms on an average six per cent. (Brande, 1200;) and it serves to render that alkaloid soluble in water and other menstrua.

Tests.—Many tests have been proposed for meconic acid; there is only one upon which any reliance can be placed, namely, the *Permuriate* or *Persulphate of iron.* This test gives, even in a very diluted solution of meconic acid, a deep red colour; and it is owing to the presence of this acid that the salt of iron causes a deep red colour in tincture and infusion of opium, as well as in all liquids containing traces of meconate of morphia, the effects of the iron-test with morphia

being counteracted by the presence of meconic acid. The red colour of the meconate of iron is not easily destroyed by diluted mineral acids, by a solution of corrosive sublimate, nor by chloride of gold, but it is by sulphurous acid and chloride of tin. In liquids containing tannic acid, *e. g.* tea or beer, the action of this test is obscured.

Detection of opium in organic mixtures.—Opium itself may be regarded as an organic solid, containing the poisonous salt which we wish to extract. It is not often that, in fatal cases of poisoning by opium or its tincture, even when these are taken in large quantity and death is speedy, we can succeed in detecting meconate of morphia in the stomach. It is probably removed by vomiting, digestion, or absorption. If the matter be solid, it should be cut into small slices; if liquid, evaporated to an extract; and in either case, digested with distilled water and a small quantity of acetic acid for one or two hours at a gentle heat. The aqueous solution should be filtered, some acetic acid added, and then acetate of lead, until there is no further precipitation. The liquid should be boiled and filtered: meconate of lead is left on the filter, while any morphia passes through under the form of acetate. The surplus acetate of lead contained in the solution should now be precipitated by a current of sulphuretted hydrogen—the sulphuret of lead separated by filtration, and the liquid evaporated at a very gentle heat to an extract, so that any sulphuretted hydrogen may be entirely expelled. On treating this extract with alcohol, the acetate of morphia may be dissolved out and tested. The meconate of lead left on the filter may be decomposed by boiling it with a small quantity of diluted sulphuric acid; and in the filtered liquid, neutralized if necessary by an alkali, the meconic acid is easily detected by the iron-test. This analysis requires care as well as some practice in the operator, in order that the morphia should be obtained in a sufficiently pure state for the application of the tests. Before resorting to this process, it is advisable to employ *trial tests* on the original liquid, in order to determine whether any meconic acid or morphia be present or not. The smell of opium may be entirely absent. The best trial tests are nitric acid and the permuriate of iron. These will give in the infusion or liquid, if it contain opium, the changes already indicated. In testing for meconic acid, it is advisable to dilute the organic liquid, if coloured, with a sufficient quantity of water to render the production of a change of colour by the test perceptible. In respect to this method of detecting the meconate of morphia in a suspected liquid, it is proper to observe, that nitric acid will indicate the presence of morphia, and permuriate of iron the presence of meconic acid, in infusions containing so small a quantity of opium as not to be precipitated by the acetate of lead.

CHAPTER XVII.

PRUSSIC ACID—DIFFERENCES IN STRENGTH—TASTE AND ODOUR—CONDITIONS UNDER WHICH THE ODOUR MAY AND MAY NOT BE DETECTED—SYMPTOMS PRODUCED BY SMALL AND LARGE DOSES—PERIOD AT WHICH THE SYMPTOMS COMMENCE—POWER OF VOLITION AND LOCOMOTION—POST-MORTEM APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—FATAL DOSE—PERIOD AT WHICH DEATH TAKES PLACE—TESTS FOR THE ACID—VAPOUR-TESTS—PROCESS FOR ORGANIC MIXTURES. BITTER ALMONDS. NOYAU. CYANIDE OF POTASSIUM.

General remarks.—HYDROCYANIC, or PRUSSIC ACID, owing to its rapid and unerring effects when taken even in comparatively small doses, is one of the most formidable poisons with which we are acquainted. As it is sold in shops, it varies considerably in strength. I have found different specimens to contain from 1·3 to 6·5 per cent. of the strong acid; but two varieties are now commonly

met with—1. The prussic acid of the London Pharmacopœia, containing about two per cent. (Phillips.) 2. Scheele's acid, containing from four to five per cent. In a case of poisoning which I had to investigate in July, 1847, the acid which was sold for Scheele's was found to contain only *two* per cent.! (Med. Gaz. xl. 171.) In another instance there was the same deficiency of strength. In short, there is no certainty respecting the strength of any two specimens sold as Scheele's acid,—a subject which requires the very serious consideration of medical practitioners who prescribe it.

Taste and odour.—The evidence derivable from the taste and odour of this poison is, in some instances, of importance. The taste is described by Dr. Christison as pungent; some state that it is hot, others that it is bitter. (Pereira.) When the common acid is taken mixed with organic liquids, the taste is not likely to be very perceptible unless the dose be exceedingly large.

With regard to the *odour*, Dr. Christison states that when diffused, it has a distant resemblance to that of bitter almonds; but it is accompanied with a peculiar impression of acridity on the nostrils and back of the throat. (Op. cit. 752.) Orfila also says that it is similar to that of bitter almonds:—this is, indeed, the common impression. There is, however, a difference between these odours; but the difference is not perceptible to the senses of all, and the only practical point requiring notice is, that the *diluted* odour of bitter almonds would probably be pronounced by many to indicate the presence of prussic acid, especially if there existed any suspicion of violent death. Even experienced medical men have to my knowledge been deceived on this point. There are some who are unable to perceive the odour of prussic acid when it exists in large proportion, whether mixed with water or other liquids; while others, again, are peculiarly susceptible of it. With some, it does not affect the olfactory nerves at all, but produces merely a sense of constriction in the fauces. These facts appear to me to explain why, on the post-mortem examination of a body, some persons may perceive the odour while others may not. When many have to form a judgment on this subject, it is much more common to find disagreement than unanimity. Again, the odour may be completely concealed by other odours. In a case communicated to me in May, 1850, by Mr. Rake, of Newark, a man swallowed a large dose of prussic acid, and was afterwards observed walking and smoking his pipe. He was found dead in a privy very shortly afterwards; but although the body was still warm, the smell of tobacco-smoke overpowered and concealed that of prussic acid. On opening the body, the smell of the acid was at once perceptible.

Symptoms.—The time at which the symptoms of poisoning *commence* in the human subject is liable to great variation from circumstances not well understood. When a large dose has been taken, as from half an ounce to an ounce of the diluted acid, the symptoms may commence in the act of swallowing, or within a few seconds. It is rare that their appearance is delayed beyond *one or two minutes*. When the patient has been seen at this period, he has been perfectly insensible, the eyes fixed and glistening, the pupils dilated and unaffected by light, the limbs flaccid, the skin cold and covered with a clammy perspiration; —there is convulsive respiration at long intervals, and the patient appears dead in the intermediate time; the pulse is imperceptible, and involuntary evacuations are occasionally passed. The respiration is slow, deep, gasping, and sometimes heaving or sobbing. The following case was communicated to me by my friend Mr. French: it presents a fair example of the effects of this poison in a large and fatal dose. A medical man swallowed seven drachms of the common prussic acid. He survived about four or five minutes, but was quite insensible when discovered, *i. e.* about two minutes after he had taken the poison. He was found lying on the floor, senseless,—there were no convulsions of the limbs or trunk, but a faint flickering motion was observed about the muscles of the lips. The process of respiration appeared to cease entirely for some seconds: it was

then performed in convulsive fits, and the act of expiration was remarkably deep, and lasted for a very long time. The deceased swallowed the poison while ascending the stairs; his body was found on the landing. The bottle had rolled some distance from him, and the stopper was lying in another direction. Simon mentions a case in which an ounce was taken, and the symptoms were precisely similar. There was, besides, coldness of the hands and feet, and no pulse could be felt. In such cases, *i. e.* when the dose is large, the breath commonly exhales a strong odour of the acid. Convulsions of the limbs and trunk, with spasmodic closure of the jaws, are usually met with among the symptoms; the finger-nails have been found of a livid colour, and the hands firmly clenched.

When a small dose (*i. e.* about thirty minims of a weak acid) has been taken, the individual has first experienced weight and pain in the head, with confusion of intellect, giddiness, nausea, a quick pulse, and loss of muscular power: these symptoms are sometimes slow in appearing. Vomiting has been occasionally observed, but it is more common to find foaming at the mouth, with suffusion or a bloated appearance of the face, and prominence of the eyes. If death result, this is preceded by tetanic spasms, opisthotonos, and involuntary evacuations. Vomiting is sometimes the precursor of recovery. (See case, Med. Gaz. xxxvi. 103.) For an account of the symptoms produced by comparatively small doses, see cases by Mr. Hicks (Med. Gaz. xxxv. 893,) by Mr. Pooley (ib. p. 859,) and one which occurred to Mr. Bishop, reported by Mr. Nunneley, (Prov. Med. and Surg. Jour. Aug. 13, 1845, p. 517.) The last case was remarkable in several particulars: the individual swallowed, it was supposed, forty minims of an acid (at three and a quarter per cent.,) and was able to give an account of his symptoms. He was conscious for some time after he had taken it, and he recollected experiencing the sensation of his jaws becoming gradually stiff and tight. It is not improbable, as Mr. Nunneley has suggested, that this poison may act more on the nerves of motion than of sensation, and that consciousness and sensibility may be retained by a person who has taken it, when, from the powerlessness of the muscles, he is unable to indicate their existence. (Prov. Trans. N. S. iii. 74.)

Period at which the symptoms commence. Power of volition and locomotion.—One of the most marked effects of prussic acid is to produce insensibility, and loss of muscular power, much more speedily than any other poison. In some instances, there may be loss of consciousness in a *few seconds;* in others, certain acts indicative of volition and locomotion may be performed, although requiring for their performance several minutes. This is one of the most important questions connected with death by prussic acid. In treating of this subject, Dr. Lonsdale says that a drachm of Scheele's acid would affect an ordinary adult *within the minute;* and if the dose were three or four drachms, it would exert its influence within ten or fifteen seconds. When the acid is stronger and the quantity larger, we are pretty certain of its *immediate* action, and the consequent annihilation of the sensorial functions. (Ed. Med. and Sur. Jour. li. 50.) Mr. Nunneley found that in some instances the action of the poison was so expeditious as to prevent the least exhibition of voluntary motion; but in the majority *of dogs*, about *twenty seconds* elapsed before any symptoms were manifested. (Prov. Trans. N. S. iii. p. 75.) Dr. Gerecke gave a tea-spoonful of concentrated prussic acid to a doe; symptoms were *instantaneously* produced, and in three seconds the animal was dead. (Casper's Wochenschrift, 26 Sept. 1846, 615.) In the Leicester case, Mr. Macaulay found that a dog was killed in three seconds; and Dr. A. Thomson has observed that a dog has been killed in two seconds. Dr. Christison ascertained that a quantity of poison, equivalent to two scruples of medicinal acid, did not begin to act on a rabbit for *twenty seconds*, and certainly, for so small an animal, two scruples are as large a dose as *five drachms* given to a grown-up girl. (Op. cit. 757.) These very different results appear to me to show clearly that experiments on animals cannot enable us

e a satisfactory solution of this question. We should rather trust to the servations made on the human subject, as well as to analogy from other s,—as, for example, to the fact of survivorship after the infliction of what mmonly regarded as instantaneously mortal wounds.

t-mortem appearances.—The body often exhales the odour of prussic acid seen soon after death; but if it has remained exposed for some time before en, and especially if it has been exposed to the open air or in a shower of he odour may not be perceptible: again, as in a case already related, the may be concealed by tobacco smoke, or other powerful odours. In a case ch a person poisoned himself with two ounces of the acid, and his body amined twenty-eight hours after death, the vapour of prussic acid which d on opening the stomach, was so powerful that the inspectors were seized izziness, and obliged to quit the room hastily. This may serve as a cau- conducting an examination. In cases of suicide or accident, the vessel which the poison has been taken will commonly be found near; but there ing to preclude the possibility of a person throwing it from him in the t of life, or even concealing it, if the appearance of the symptoms should ayed. Owing to the great volatility of the poison, the vessel may, if left ed, not retain the odour when found. Putrefaction is said to be accele- n these cases; but from what I have been able to collect, there seems to ground for this opinion, any more than in the case of poisoning by opium. ase by Mr. Nunneley, Prov. Med. Jour. July 30, 1845.) Orfila has that in most instances of *sudden death*, from whatever cause, putrefaction *eris paribus*, accelerated; and the fact that in one or two instances of death russic acid, the bodies have speedily putrefied, has improperly led to this ion being set down as one of the characters of poisoning by the acid.

post-mortem appearances are very slight. *Externally*, the body is com- livid, or the skin is tinged of a violet colour; the nails are blue, the fingers ed, and the toes contracted; the jaws firmly closed, with foam about the , the face often pallid, but sometimes bloated and swollen, and the eyes een observed to be wide open, fixed, glassy, very prominent and glisten- d the pupils dilated: but this condition of the eyes exists in other kinds th. *Internally*, the venous system is gorged with dark-coloured blood; the A and alimentary canal are in their natural state; but in several instances ave been found more or less reddened. The mucous membrane of the sto- of a dog which died in a few minutes from a dose of three drachms of e's acid, was intensely reddened throughout, presenting the appearances ith in cases of arsenical poisoning. In a large number of experiments dogs, Mr. Nunneley found that there was generally a congested condi- the mucous membrane of the stomach: if empty at the time the poison ken, the organ was found much contracted, and of a brick-red colour. ppearance of congestion was observed on the mucous membrane of the , the rectum, and conjunctiva, when the acid was applied to these parts. Trans. N. S. iii. p. 79.) The same redness was noticed in the case of the n epileptics. (On Poisons, 667.) Dr. Geoghegan, of Dublin, has commu- l to me the particulars of a case in which this redness of the stomach was arked. In April, 1847, a healthy man, æt. 30, swallowed a large dose sic acid. He was soon afterwards found dead in his bed. The body was ed five hours afterwards: rigidity had commenced, but there was some ı. The face was pale, the eyes half closed, not presenting any remarkable ıcy or prominence, nor was there much dilatation of the pupils. The was closed, and no froth issued from it. The abdomen was the only cavity ed. The muscles were red, and gave out, on section, a good deal of fluid which had a strong odour of prussic acid; the odour of the poison was also ible in the peritoneal cavity. About eight ounces of a thick farinaceous ere found in the stomach: the odour of prussic acid was very perceptible

in this organ, but it was mixed with that of rancid food. The mucous membrane had every where, except at the splenic end and posterior wall, a vivid inflammatory redness of a well marked character, and it was lined with a layer of viscid mucus to a considerable extent. The coats were not thickened, but the submucous coat presented ramified vascularity; the peritoneal coat was also decidedly red. The posterior wall, at the splenic end, was of a chocolate colour, with scattered petechiæ; the great venous trunks stood out in relief as dark blue lines. The mucous membrane, even when washed three times in water, gave out a strong odour of prussic acid. In a case which I examined in May, 1850, in which death had been caused by a large dose of the acid, there was also a general redness of the stomach. Hence an irritant action may be fairly assigned to this poison.

Quantity required to destroy life.—This is a very important question: and it is made somewhat perplexing by the fact, that beyond a certain dose, the weak and the strong acid appear to act with equal rapidity. (Christison, 658.) The *smallest* dose which is reported to have caused death was in a case which occurred to Mr. Hicks. (Med. Gaz. xxxv. 896.) The female, a healthy adult, died in twenty minutes from a dose equivalent to *nine-tenths* of a grain of anhydrous prussic acid. This was equivalent to *forty-nine grains* of the London Pharmacopœial acid; and taking Scheele's acid at four per cent. (Pereira,) to about *twenty-five grains* of Scheele. In an interesting case reported by Mr. T. Taylor, (Med. Gaz. xxxvi. 104,) a stout healthy man swallowed this dose, *i. e.* nine-tenths of a grain, by mistake, and remained insensible for *four hours*, when he vomited, and began to recover. The vomited matters had *no odour* of the poison, showing that if not concealed by other odours, the whole of the acid must have been here absorbed. He had a very narrow escape of his life. Dr. Banks has published a case in which a female recovered after swallowing thirty drops of prussic acid, (Ed. Med. and Sur. Jour. xlviii. p. 44;) but the interest of this case is lost, owing to the strength of the acid not having been determined.

Recoveries from large doses.—The *largest* dose from which an adult has recovered was probably in a case which occurred to Mr. Bishop, reported by Mr. Nunneley. (Prov. Med. Jour. Aug. 13, 1845, p. 517.) The person swallowed, it was supposed, *forty minims* of an acid at three and a quarter per cent. Taking the minim as equal to the grain, although it may be a little more or less, according to circumstances, this is equivalent to about *one grain and one-third* of anhydrous acid. The man was for a short time conscious, got into bed after taking the poison, and spoke. He felt his jaw become stiff, and then remained insensible until roused by the cold affusion. The fact of recovery having taken place on this occasion, must not lead us to suppose that such a large dose could be commonly taken with impunity. If we refer to the chapters on arsenic and corrosive sublimate, we shall find that persons have recovered from doses of these poisons, much larger than those which have proved fatal in other cases. The same circumstance is observed in respect to all other poisons. Judging by the effects produced in Dr. Geoghegan's case from 0·66 grain of anhydrous acid,—from the fact that death took place in Mr. Hicks' case from nine-tenths of a grain, and that, in another instance, a strong adult had a narrow escape of his life from the same dose, we shall not be wrong in assuming that a quantity of Scheele's acid (at five per cent.) *above twenty grains* (i. e. *one grain of anhydrous acid*,) or an equivalent portion of any other acid, would commonly suffice to destroy the life of an adult. This I believe to be the nearest approach we can make to the *smallest fatal dose*.

There appears to be no strict relation between grains, minims, and drops. I have found by experiment, that sixty minims (or one drachm) of the same prussic acid, at two per cent., measured in three different measures, weighed respectively 61, 62·5, and 64 grains (On Poisons, p. 673,) while sixty minims dropped from an eight ounce bottle of the acid at two per cent. were equivalent to 42 drops,—and the same measure of an acid at four per cent. was equivalent to

40 drops. The volume and weight of drops vary according to the nature of the liquid, the size of the bottle, the width of the lip of the bottle, and the angle of inclination. Hence it is a most uncertain mode of measuring, and in this edition I have substituted "grains" for "drops."

Period at which death takes place.—When the dose is two drachms and upwards, we may probably take the average period for death at from *two* to *ten minutes*. In Mr. Hicks's case, forty-nine grains of the Pharmacopœial acid destroyed life in twenty minutes. It is only where the dose is just in a fatal proportion, that we find the individual to survive from half an hour to an hour. In this respect, death by prussic acid is like death by lightning:—the person in general either dies speedily or recovers altogether. According to Dr. Lonsdale, death has occurred in the human subject as early as the *second*, and as late as the *forty-fifth* minute. But although death does not commonly ensue until after the lapse of a few minutes, insensibility, and consequently a want of power to perform acts of volition and locomotion, may come on sometimes in a few seconds. The time at which this loss of power is supposed to take place has frequently become an important medico-legal question; and on the answer to it, the hypothesis of suicide or murder in a particular case, may rest.

Chemical analysis.—Prussic acid is limpid like water; it possesses a faint acid reaction, and its vapour has a peculiar odour, which, when the acid is concentrated, although not at first perceptible, is sufficient to produce giddiness, insensibility, and other alarming symptoms. The tests which are best adapted for the detection of this poison, either in liquid or vapour, are equally applicable whether the acid be concentrated or diluted, and, so far as the detection of the *vapour* is concerned, whether it be pure or mixed up with organic matter.

Tests in the simple state.—The tests are three in number:—the *Silver*, the *Iron*, and the *Sulphur* tests. 1. *Nitrate of Silver.*—This yields, with prussic acid, a dense white precipitate, speedily subsiding in heavy clots to the bottom of the vessel, and leaving the liquid almost clear. The precipitate is identified as cyanide of silver by the following properties:—*a*. It is insoluble in cold nitric acid; but when drained of water, and a sufficient quantity of strong acid is added, it is easily dissolved on boiling. *b*. It evolves prussic acid when digested in muriatic acid. *c*. The precipitate, when *well dried* and heated in a small reduction-tube, yields cyanogen gas, which may be burnt at the mouth with a rose-red flame and blue halo. This is a well marked character, and at once identifies the acid which yielded the precipitate as prussic acid. By this property, the cyanide is eminently distinguished from all the other salts of silver.

In the employment of the silver-test for the detection of the *vapour* of the poison, we place a few drops of the silver solution in a watch-glass, and invert it over another watch-glass containing the suspected poisonous liquid. Cyanide of silver, indicated by the formation of an opake white film in the solution, is immediately produced, if the acid be only in a moderate state of concentration. One drop of the pharmacopœial acid (containing less than the 1-50th of a grain) produces speedily a visible effect. When the prussic acid is much diluted, a few minutes are required; and the opake film begins to show itself at the edges of the silver solution. In this case the action may be accelerated by the heat of the hand.

2. *The Iron-Test.*—The object of the application of this test is the production of *Prussian Blue*. We add to a small quantity of the suspected poisonous liquid a few drops of potash and of a solution of green sulphate of iron. A dirty green or brownish precipitate falls: on shaking this for a few minutes, and then adding diluted muriatic or sulphuric acid, the liquid becomes blue; and Prussian blue, of its well known colour, unaffected by diluted acids, subsides. If the prussic acid be in very small quantity, the liquid is at first yellow, from the salt of iron formed; it then becomes green, but the precipitate ultimately subsides so as to appear of a blue colour in the mass. The same result is ob-

tained by adding the solution of the iron-salt to the potash-solution of the cyanide of silver; and thus, in this way, the two tests may be applied to only *one* portion of the poison.

The iron-test may be employed for the detection of the *vapour* of prussic acid, by the same method as that described in speaking of the silver-test. For this purpose we place a few drops of caustic potash in a small white saucer, and invert it over the suspected liquid. After a few minutes a drop of solution of green sulphate of iron may be added, and then a drop of diluted muriatic acid, —Prussian blue appears. The recently precipitated mixed oxides of iron with potash may be placed in the upper vessel with the same results. The silver and the iron-tests may be in this way easily conjoined in testing the same quantity of poison. If the precipitated cyanide of silver, obtained by the addition of nitrate of silver to the suspected liquid, be moistened with strong muriatic acid, and the vapour collected in a watch-glass or saucer, on the plan just described, Prussian blue will be procured, and thus strongly corroborate the action of the silver-test.

3. *The Sulphur-Test.*—Baron Liebig has proposed the following process for detecting prussic acid as a *liquid*. (Oesterreichische Med. Wochenschrift, 27 März, 1847, 396.) If a small quantity of hydrosulphuret of ammonia (containing a little excess of sulphur) be added to a few drops of the solution of prussic acid, and the mixture be gently warmed, it becomes colourless, and, on evaporation, leaves sulphocyanate of ammonia—the sulphocyanic acid being indicated by the intense blood-red colour produced on adding to the residue a solution of a persalt of iron: this colour immediately disappears on adding one or two drops of a solution of corrosive sublimate. This test is very delicate, and it therefore requires some care in its application: thus, if the boiling and evaporation be not carried far enough, the persalt of iron will be precipitated black by the undecomposed hydrosulphuret of ammonia; and, if the heat be carried too far, the sulphocyanate of ammonia may itself undergo decomposition, and be lost. It will be perceived, too, that it requires a longer time for its application than either the silver or the iron-test.

The great utility of the *sulphur-test*, however, is in its application to the detection of the minutest portion of prussic acid when in the state of *vapour*. In this respect it surpasses any other process yet discovered. In order to apply it, we place the diluted prussic acid in a watch-glass, and invert over it another watch-glass, holding in its centre one drop of the hydrosulphuret of ammonia. No change apparently takes place in the hydrosulphuret; but if the watch-glass be removed after the lapse of from half a minute to ten minutes, according to the quantity and strength of prussic acid present, sulphocyanate of ammonia will be obtained on gently heating the drop of hydrosulphuret and evaporating it to dryness. With an acid of from three to five per cent. the action is completed in ten seconds. The addition of one drop of persulphate of iron to the dried residue, brings out the blood-red colour instantly, which is intense in proportion to the quantity of sulphocyanate present. Such is the simple method of employing the test. When the prussic acid is excessively diluted, the warmth of the hand may serve to expedite the evolution of the vapour.

In detecting the vapour, the *sulphur-test* acts, *cæteris paribus*, more rapidly and more delicately than the silver-test; but the two may be usefully employed together in corroboration of each other. If a suspected liquid, placed in a watch-glass, produce a film on a drop of nitrate of silver, the reaction will be very speedy with the hydrosulphuret. The silver-test acts *visibly*, and therefore serves to guide us: the sulphur-test acts invisibly; for there is no apparent change unless the glass be left so long that the ammonia is spontaneously evaporated, and the sulphur oxidated or deposited.

Prussic Acid in Organic Liquids. Detection by vapour without distillation. —The organic liquid may be placed in a wide-mouthed bottle, to which a watch-

glass has been previously fitted as a cover. The capacity of the bottle may be such as to allow the surface of the liquid to be within one or two inches of the concave surface of the watch-glass. The solution of *Nitrate of silver* is then used as a trial-test in the way already described. If the 1-200th of a grain of prussic acid be present, and not too largely diluted, it will be detected (at a temperature of 60°) by the drop of nitrate of silver being converted into an opake white film of cyanide of silver, the chemical change commencing at the margin. We may then substitute for the nitrate of silver the hydrosulphuret of ammonia, and proceed in the way above described. By this process I have detected prussic acid in the stomach of a person poisoned by it, as late as twelve days after death. After the stomach had been exposed for a few days, all traces of the poison had disappeared.

Detection by distillation.—This process was originally suggested by Lassaigne. The organic liquid should be distilled in a water bath, at 212°, and about one-sixth or one-eighth of the contents of the retort collected in a receiver kept cool by water. The tests may now be applied to the distilled liquid. If the trial-tests indicate that the quantity of poison is small, a solution of nitrate of silver or caustic potash may be placed in the receiver, to fix the acid as it distils over; Prussian blue may then be procured in the way described, or the vapour may be at once absorbed by hydrosulphuret of ammonia in the receiver, and the liquid evaporated to obtain sulphocyanate. Prussic acid has been found in the stomach by *distillation*, so late as *seven* days after death, although the odour could not be perceived before distillation. Mr. West states that he was able to detect prussic acid, on distillation, by the odour, and the silver and iron-tests, *twenty-three* days after death; although no pains had been taken to insure its preservation, and not more than four-tenths of a grain of anhydrous acid could have originally existed in the contents of the stomach. (Prov. Med. Jour., July 23, 1845.)

Detection of prussic acid in the tissues.—The poison may be easily detected in the blood, secretions, or any of the soft organs, by placing the vapour in a bottle, and collecting it in the way already described. This will be found to be far more convenient and satisfactory than the process by distillation. In the case of a dog poisoned by prussic acid, Mr. Hicks brought me the stomach after it had been exposed twenty-four hours, and thoroughly washed under a current of water, and yet the poison was readily detected by placing the whole organ in a bottle, and absorbing the vapour by nitrate of silver. This shows how completely the animal tissues are penetrated by prussic acid, and how firmly it is retained by them. The poison has been thus discovered in the blood and in the serous exhalation of the chest.

Oil of Bitter Almonds.

Symptoms and effects.—A man, aged forty-eight, swallowed two drachms of the ethereal oil of bitter almonds. In a few minutes afterwards, he was found by his servant with his features spasmodically contracted, his eyes fixed, staring, and turned upwards. The chest was expanded convulsively and hurriedly. In twenty minutes he was insensible, the pupils immovable, the breathing slow and stertorous,—the breath having a strong odour of bitter almonds, and the pulse feeble. He died *half an hour* after he had taken the poison. On inspection, the whole of the body, and the blood which escaped, smelt strongly of bitter almonds; the teeth were fixed, the lips pale, fingers contracted, and the nails blue. The mucous membrane of the stomach and intestines presented an inflammatory redness, and there was turgescence of the brain. The blood, bile, and the muscles, had a deep violet colour. (Ed. Med. and Sur. Jour. xxii. 232.) The following case occurred to Mr. Chavasse, of Birmingham. A druggist swallowed by mistake half an ounce of "almond flavour." In *half a minute* he fell down in a state of syncope; his face being deadly pale, and his pulse im-

perceptible. After a few minutes he came to himself, and vomited some undigested food mixed with bile and strongly impregnated with the odour of bitter almonds. Delirium, with slight convulsions, came on; he then became sensible, and conversed upon his condition; but again gradually relapsed into delirium, his eyes being prominent and brilliant. In a few minutes he again became sensible, and slowly recovered from the effects of the poison. The quantity of "almond flavour" which he had taken was estimated to contain about *half a drachm* of the essential oil. I cannot avoid remarking, that we have here another instance of the disgraceful state of medical police in this country, in the fact that a deadly poison like this is allowed to be sold by druggists for the purpose of giving flavour to pastry and liqueurs! In the above case, *thirty drops* of the essential oil were taken without destroying life, although the patient had a very narrow escape. Dr. Bull, of Hereford, has communicated to me a case in which less than twenty drops (*seventeen*) destroyed the life of a woman, aged forty-nine, in half an hour. For a case of poisoning by this oil, reported by Mr. Iliff, jun., see Lancet, Dec. 1, 1849, page 575.

Is the *vapour* of this oil sufficient to produce fatal effects? This question was raised in the subjoined case, which occurred in London, in 1838. The deceased, the wife of a publican, had been clearing out a closet, which contained, among other liquors, a bottle of the essential oil of bitter almonds. She was suddenly heard to call out. A servant found her pale and faint, and she complained of sickness. There was a strong odour in the room, and deceased said that the corks of some of the bottles had come out, and the smell had made her feel sick. She was removed to bed, but died before any medical assistance could be obtained. There was no motive for the deceased committing suicide, and it was a subject of inquiry, whether the vapour alone might not have caused death. This question was set at rest by an inspection of the body. Some of the poison was found in the stomach, and there was a very strong odour of bitter almonds in the contents. It was, therefore, clear that the deceased must have swallowed a portion of the poison; whether from motives of curiosity or not, it is impossible to say. The medical witness in answer to a question, properly stated that less than a teaspoonful might cause the death of an adult. The vapour may produce vertigo and stupor; but unless long respired, it would not be likely to cause fatal effects. In 1837–38, there were four cases of poisoning by this oil. This poison is sold to the public, in quantities of not less than a quarter of an ounce, at the rate of five shillings per ounce. The liquid called *Almond flavour*, spirit of almonds, or essence of peach-kernels, contains half a drachm of the essential oil to one ounce of spirit. It is sold in quantities of not less than a quarter of an ounce, at the rate of one shilling per ounce. The chief use of this liquid is for the purpose of flavouring confectionary. Serious symptoms have in some instances been produced by it; and as cooks and confectioners who use it are not aware that they are administering prussic acid to their customers, it is possible that accidents may arise from this practice. A flavour is at all times dearly purchased if it depends on even a small dose of poison. Within a recent period, a liquid has been sold for flavouring confectionary under the name of *Essence of Jargonelle Pear*. It is a noxious artificial compound made by distilling oil of grain, or fusel oil, with acetate of potash and sulphuric acid. In the Pharmaceutical Journal for November, 1851 (page 214) it is stated that a child which had on two occasions eaten confectionary flavoured with about one drop of the essence of pear, became partially comatose, with livid lips and feeble pulse. The symptoms resembling poisoning, observed in children, may very commonly be referred to the eating of confectionary which is coloured or flavoured with various kinds of poison.

Another artificial fruit-essence has been still more recently brought into notice —namely, the "*Essence of Ripstone Pippin*," or "oil of apples." It is procured from a mixture of bichromate of potash, sulphuric acid, and amylic alco-

hol (Chemical Record, Jan. 17, 1852, page 44)—all substances of a noxious nature. There will thus be for the younger portion of the public a choice of confectionary coloured green with arsenic or flavoured with essential oil of almonds (containing prussic acid,) or the artificial essences of apples and pears, the effects of which still remain to be determined.

Noyau. Cherry Ratafia.

These liqueurs, which have the smell of bitter almonds, are considered to be poisonous when taken in large doses. The quantity of prussic acid present in them is liable to vary; it may be separated by distillation at a gentle heat, and then tested. I have found that an ounce and a half of good noyau, having a strong odour and flavour, when distilled two-thirds, yielded scarcely a trace of prussic acid either by the silver or iron test. It had been kept some time in a well closed bottle. An equal quantity of cherry ratafia, similarly treated, gave me no ponderable quantity of Prussian blue.

Laurel-water. Cherry Laurel-water.

This is a very weak solution of prussic acid, containing only about one-fourth of a grain per cent. of the strong acid, but it is stated to be more poisonous than this quantity of acid would indicate. (Pereira, ii. 1542.) In some specimens which I procured by distilling the bruised tops and the fine shoots of the laurel with water, the odour was powerful; but the proportion of prussic acid present was considerably less than this. It is a limpid colourless liquid, possessing a strong odour of bitter almonds, and producing, in large doses, the usual effects of poisoning by prussic acid. Cherry laurel oil.—By distillation, the leaves of the plant yield also an essential oil, resembling that of the bitter almond, but much weaker, as it contains on an average less than three per cent. of prussic acid. According to Christison, almost every part of the plant is poisonous, but especially the leaves, flowers, and kernels; the pulp of the cherry is not poisonous. Articles of food are often flavoured with the leaves, but accidents are said to have arisen from this practice. [Dr. Griffith notes that accidents have happened from eating the fruit of the wild cherry (*Cerasus Virginianus and C. Serotinus,*) owing to the hydrocyanic acid present in these berries. From the experiments of Mr. Procter (*Amer. Jour. Pharm.* iii. 191,) it appears to exist in some quantity more especially in the kernels. Dr. Beck cites the case of a child to whom the fruit proved highly deleterious, and several other analogous instances have been reported from time to time.—H.]

Cyanide of Potassium.

Symptoms and effects.—This is a poisonous salt, now much used in the art of electro-gilding and plating. It is a solid, sometimes seen crystallized, at others in the form of a white chalky-looking powder. It is without odour until put into water, when it is freely dissolved, forming an alkaline solution, from which prussic acid is abundantly evolved. It acquires a strong smell in a damp atmosphere, and becomes dark-coloured. The cyanide of potassium is used on the continent as a medicine, and a few years since it occasioned the death of a person at St. Malo, under the following circumstances. A physician prescribed for the deceased rather more than one drachm of the cyanide in two ounces and a half of orange flower water and syrup; and of this mixture three spoonfuls were to be taken daily. It seems that table-spoonfuls were taken, and the patient died in three-quarters of an hour after the first dose. None of the poison was found in the stomach; but a portion of the mixture from which the dose had been taken was examined and found to contain cyanide of potassium. A criminal procedure was instituted against the physician, and he was fined and imprisoned. M. Malaguti, who gave evidence on the occasion, stated that a dog was killed in a

few minutes after taking less than three grains of the cyanide in solution; and that the largest medicinal dose of this substance to a human being was five-sixths of a grain. (Lancet, Jan. 1843.) The mixture in the above case contained about three grains of the cyanide in one drachm; therefore, had tea-spoonfuls been taken by the deceased, he would have taken quite sufficient to destroy life. The medicine had evidently been prescribed by a person totally ignorant of its poisonous properties. Another case occurred at Breslau, in which a man, aged thirty, died in a *quarter of an hour* under all the symptoms of poisoning by prussic acid, after taking a dose of a mixture containing fifteen grains of cyanide of potassium, which had been prescribed for him by his medical attendant. (Henke, Zeitschrift der S. A., 1843, 7. See also Ann. d'Hyg., 1843, i. 404.)

Cases of poisoning by this agent have been rather frequent of late years. The cyanide of potassium is much used as a solvent for silver, and is largely employed by coiners for covering base metal. In most of the cases the poison has proved so rapidly fatal, that the persons have died before they were seen by a medical practitioner. The symptoms have not therefore been observed; but so far as we can form a judgment, they are identical with those produced by prussic acid. (See Med. Times, Oct. 12, 1850, p. 390; also Nov. 9, 1850, p. 482; and July 12, 1851, p. 41.)

CHAPTER XVIII.

NARCOTIC POISONS CONTINUED.—HYOSCYAMUS NIGER. LACTUCA VIROSA AND SATIVA—LETTUCE-OPIUM—SOLANUM DULCAMARA AND NIGRUM—CAMPHOR—SYMPTOMS—ALCOHOL—SYMPTOMS—TREATMENT—ANALYSIS—ACTION OF ETHER AS A LIQUID—SYMPTOMS AND APPEARANCES—CHLOROFORM—SYMPTOMS AND APPEARANCES.

Hyoscyamus Niger.

All the parts of this plant, which is commonly known under the name of Henbane, are poisonous. The seeds produce the most powerful effects, then the roots, and lastly the leaves. The vapour evolved from the fresh-cut leaves has been known to produce vertigo, stupor, and syncope. In small or medicinal doses, henbane has a narcotic action; but when taken in large doses, it produces those effects usually assigned to the narcotico-irritant class.

Symptoms and appearances.—The best summary of these is given by Wibmer, (Arzneimittel, Art. Hyoscyamus Niger.) When the dose is not sufficient to destroy life, the symptoms are,—general excitement, fulness of the pulse, flushing of the face, weight in the head, giddiness, loss of power and tremulous motion of the limbs, somnolency, dilatation of the pupils, double vision, nausea, and vomiting. After a time these symptoms pass off, leaving the individual merely languid. When a large quantity of the root or leaves has been eaten,—an accident which has occurred from the plant having been mistaken for other vegetables,—then other and more serious effects are manifested. In addition to the above symptoms in an aggravated form, there will be loss or incoherency of speech, delirium, confusion of thought, insensibility, coma, and, sometimes, a state resembling insanity (see Med. Gaz. vol. xlvii. p. 640;) the pupils are dilated, and insensible to light; there is coldness of the surface, cold perspiration, loss of power in the legs, alternating with tetanic rigidity and convulsive movements of the muscles; the pulse small, frequent, and irregular; the respiration deep and laborious. Occasionally there is nausea, with vomiting and diarrhœa. Death takes place in a few hours or days, according to the severity of the symptoms.

The special effect of this poisonous plant is manifested in its tendency to produce a general paralysis of the nervous system.

There are other varieties of hyoscyamus which are also poisonous.

LACTUCA.

The two species of lettuce known under the names of LACTUCA SATIVA and VIROSA (strong-scented lettuce) contain a principle which is possessed of feeble narcotic properties. Orfila has found that the extract prepared by evaporation at a low temperature acts upon the brain and nervous system of animals, although very large doses were required for the production of narcotic effects. There is no record of these plants having exerted a poisonous action in the human subject. The inspissated juice of the lettuce is well known under the name of *lactucarium* or *lettuce-opium*.

SOLANUM.

There are two species of this plant—the SOLANUM DULCAMARA, *Bitter-sweet* or *Woody-nightshade*, which has a purple flower and bears red berries; and the SOLANUM NIGRUM, or *Garden-nightshade*, with a white flower and black berries. Dunal gave to dogs four ounces of the aqueous extract, and, in another experiment 180 ripe berries of the Dulcamara, without any ill effects resulting. On the other hand, Floyer states that thirty of the berries killed a dog in three hours. (Wibmer, op. cit. SOLANUM.) These differences may perhaps be reconciled by supposing that the active principle *Solania*, on which the poisonous properties of both species depend, varies in proportion at different seasons of the year. In one instance, a decoction of the Dulcamara is said to have produced in a man dimness of sight, vertigo, and trembling of the limbs—symptoms which soon disappeared under slight treatment. (For a case of poisoning by the decoction, see Med. Gaz. xlvi. 548.) Orfila found that the extract of Solanum nigrum had a very feeble effect as a poison; and the fatal cases reported to have been caused by it are perhaps properly referrible to belladonna, for which it may have been mistaken. The single death from Dulcamara reported in the Registration returns for 1840 may have been due to a mistake of this kind.

CAMPHOR.

In the few cases of poisoning by camphor which have been observed and recorded, its effects were somewhat different, although both in man and animals they were referrible to an impression on the brain and nervous system.

Symptoms and effects:—The following case is reported by Mr. Hallett, of Axminster:—A woman swallowed in the morning about a scruple of camphor dissolved in rectified spirits of wine and mixed with tincture of myrrh. In half an hour she was suddenly seized with languor, giddiness, occasional loss of sight, delirium, numbness, tingling and coldness of the extremities, so that she could hardly walk. The pulse was quick and respiration difficult, but she suffered no pain in any part. On the administration of an emetic, she vomited a yellowish liquid, smelling strongly of camphor. In the evening the symptoms were much diminished, but she had slight convulsive fits during the night. The next day she was convalescent; the dyspnœa, however, continued more or less for several weeks. The dose did not probably exceed *twenty grains*:—this is the smallest dose of camphor which appears to have been attended with serious symptoms. In a case which occurred to Wendt, of Breslau, eight scruples were swallowed by a drunkard, dissolved in spirit. The symptoms were vertigo, dimness of sight, delirium, and burning pain in the stomach. There was *no vomiting*: the man recovered. In another, reported by Mr. Stokes, a woman swallowed *half an ounce* of camphor dissolved in oil. In two hours she was delirious; her face pale; pupils dilated; hands and feet cold; pulse 120. There was no pain, vomiting (except as the results of emetics,) or purging. She recovered in a few hours. (Med.

Times, June 10, 1848, p. 88.) These and other cases show that camphor cannot be regarded as a very active poison. (Wibmer, op. cit. iii. 212.) In Orfila's experiments on animals, the mucous membrane of the stomach was found inflamed (ii. 493.)

In a series of cases reported by Dr. Schaaf, the symptoms caused by camphor were those of a narcotico-irritant poison. A woman gave a tablespoonful (180 grains) of powdered camphor to three of her children as a vermifuge. Two of the children were respectively of the ages of three and five years, the third was an infant aged eighteen months. The first symptoms were pallor of the face, with a fixed and stupid look. Delirium followed, with a sense of burning in the throat, and great thirst. Vomiting, purging, and convulsions supervened, and in one child the convulsions were most violent. The two elder children, after suffering thus for three hours, fell into a comatose sleep, and on awaking the symptoms passed off. The infant died in seven hours, not having manifested any return of consciousness from the first occurrence of convulsions. (Med. Gaz. vol. xlvii. p. 219.) The severity of the symptoms is fully explained by the enormous dose administered to these young subjects. In a dose of one drachm given in a clyster, camphor produced alarming symptoms. (Med. Gaz. xlviii. 552.)

Alcohol.

Symptoms.—A large quantity of spirit has been known to destroy life speedily, although such a case is rare. Orfila mentions an instance in which a man died immediately from the effects of a large dose of brandy. (Op. cit. ii. 528.) In general, the symptoms come on in the course of a few minutes. There is confusion of thought, with inability to stand or walk, a tottering gait, and vertigo, followed by coma. Should the individual recover from this state, vomiting and sickness supervene. This form of poisoning presents some singular anomalies:—thus the insensibility may come on suddenly after a certain period. Dr. Christison met with a case where the individual fell suddenly into a deep stupor some time after he had swallowed sixteen ounces of whiskey: there were none of the usual premonitory symptoms. In another instance a person will apparently recover from the first effects, then suddenly become insensible, and die convulsed. Convulsions are, however, by no means a necessary attendant upon poisoning by alcohol. Orfila makes their absence a ground of diagnosis between poisoning by alcohol and opium (Op. cit. ii. 530,)—and Dr. Ogston only observed them twice out of many cases: the subjects in these two instances were young. In poisoning by alcohol, the supervention of the symptoms is not commonly so rapid as to prevent an individual from performing locomotion or certain acts of volition. The more concentrated the alcohol, the more rapidly are the symptoms induced, and they are then more severe in their character. Diluted alcohol generally produces the stage of excitement before stupor, while in the action of concentrated alcohol there may be profound coma in a few minutes. This appears to indicate an action by sympathy on the nervous system, as the diluted alcohol is in a condition most favourable to absorption. Alcohol may act as a poison by its *vapour*. If the concentrated vapour be respired, it will produce the usual effects of intoxication. It is generally known that persons who have been for the first time employed in bottling spirits are easily intoxicated by the alcoholic vapour. There is a case on record in which a child two years of age was thrown into an apoplectic stupor by the alcoholic vapour of Eau de Cologne. In this way a child might be destroyed, and no trace of the poison be found in the stomach.

Post-mortem appearances.—In respect to post-mortem appearances, the stomach has been found inflamed—the mucous membrane having been in one case of a bright red, and in another of a dark red-brown colour. When death has taken place rapidly, there will be a strong odour of spirits in the contents; but this may not be perceived if many hours have elapsed before the inspection is made.

The brain is found congested, and in some instances there is effusion of blood or serum beneath the membranes. In a case observed by Dr. Geoghegan, in which a pint of spirits had been taken, and proved fatal in eight hours, black extravasation was found on the mucous membrane of the stomach; but no trace of alcohol could be detected in the contents. [Dub. Med. Press, i. 293.]

Ether.

Symptoms and appearances.—The effects produced on the system by the administration of Sulphuric or any other form of ether, are not unlike those occasioned by alcohol. Orfila found that about half an ounce of sulphuric ether administered to a dog caused, in a few minutes, a disposition to vomit. This was followed by vertigo, and, in ten minutes, by an entire loss of power in the muscles. Respiration was painful and hurried, but there were no convulsions. After a slight abatement in the symptoms, the dog fell into a state of insensibility, and died in three hours. The whole of the mucous membrane of the stomach was of a blackish-red colour, and, with the other coats, intensely inflamed. There was slight inflammation in the duodenum; but the rest of the alimentary canal was in a healthy condition. The heart contained black blood partly coagulated: the lungs were gorged with fluid blood. (Op. cit. ii. 531.)

Very little is known concerning the action of large doses of *liquid* ether taken into the stomach. It has, in moderate doses, a hot burning taste, and produces, during swallowing, a sense of constriction in the throat. It causes, like alcohol, great excitement and exhilaration, with, subsequently, intoxication; but persons may become habituated to it; and thus, after a time, it may be taken in very large quantities with comparative impunity. The medicinal dose is from half a drachm to two drachms. Dr. Buchanan has known *seven drachms* of it taken at once: it produced, at the pit of the stomach, a most uneasy sensation of heat and pain, which only the callous stomach of a dram drinker could withstand. (Med. Gaz. xxxix. 715.) In 1845, a young man was brought before one of the London Police-magistrates in a stupefied state: to those present he appeared to be intoxicated. It was proved in evidence that he was in the habit of taking ether, and that he was then labouring under its effects. It appeared that he frequented the shops of druggists, and swallowed this liquid in large doses. There is no instance reported of ether having caused death when taken in the liquid form: but it has never been swallowed at once in the same excessive doses as alcohol. It does not admit of dilution with water to the same degree as alcohol, and therefore it acts, *cæteris paribus*, as a more violent local irritant. It requires ten parts of water to dissolve one of ether: hence, unless, as Dr. Buchanan has remarked, the water be in very large proportion, it does not render the ether palatable to most persons. It is at present impossible to give any precise opinion respecting the smallest quantity of this liquid which would destroy the life of an adult. *Hoffman's Liquor* is a mixture of alcohol and ether.

Ether vapour.—The vapour of ether, when respired, may act as a narcotic poison. Several cases in which it has thus proved fatal, when it has been administered for the purpose of producing insensibility during surgical operations, are recorded, and for an account of these, as well as of poisoning by the vapour generally, I must refer to the separate work On Poisons, (Am. Ed. 590.)

Chloroform.

This liquid, when taken in a large dose, appears to affect the system like alcohol; but as a *liquid* it cannot be regarded as an active poison. I have elsewhere recorded a case communicated to me by Mr. Jackson of Sheffield, in which a man swallowed *four ounces* of chloroform. He was able to walk for a considerable distance after taking this dose, but he subsequently fell into a state of coma —the pupils were dilated, the breathing stertorous, the skin cold, the pulse im-

perceptible, and there were general convulsions. He recovered in five days. (Med. Gaz. vol. xlvii. p. 675.)

Chloroform vapour. Symptoms.—The symptoms which the vapour of chloroform produces are very similar to those produced by the vapour of ether; but the individual passes much more rapidly into a state of insensibility with stertorous breathing. From being at first excited, he becomes motionless—the pupils widely dilated—the sphincters lose their contractile power,—the face is pale, the lips congested, the breathing becomes slow, the surface cold, and the pulse gradually sinks. There is an entire loss of sensibility. The sinking of the pulse in some cases is so rapid as to expose the patient to death by syncope (see case Med. Gaz. xl. 1036.) In some instances violent convulsions have supervened, even where the dose has been only from half a drachm to a drachm. These effects may be occasionally due to idiosyncrasy, or to latent organic disease. The fatal effects of the vapour are likely to be manifested when it is breathed rapidly and unmixed with air. There is no doubt that in a concentrated state it is a powerful narcotic poison. It is absorbed into the blood, which it darkens, as in asphyxia, and circulates throughout the system. The blood, however, is directly poisoned by it.

Post-mortem appearances.—In an interesting case reported by Dr. Meggison, a girl, æt. 15, had the vapour administered to her on a warm cloth. The quantity of chloroform used was about one drachm. In about half a minute, she became insensible—the lips were suddenly blanched, and it was observed that one arm was rigid. The respiration was quick, but there was no stertor. The patient suddenly spluttered at the mouth, as if in an epileptic fit. Attempts were made to revive her, but she was dead in from two to three minutes after commencing the inhalation. On inspection, the pulmonary tissue was found greatly congested. There was a bloody froth in the bronchi, mixed with mucus: —the epiglottis was reddened. The brain and its membranes were more congested than usual, and the ventricles contained more than the usual quantity of serum. The abdominal viscera were also highly congested. (Med. Gaz. xli. 250-254.) These appearances correspond to those observed by Dr. Glover, and Mr. Wakley, jun., in its action on animals. There can be no doubt that chloroform was really the cause of death. In another case of poisoning in the human subject, fully reported by Dr. Jamieson, in which the quantity inhaled was probably three or four drachms, the appearances of general congestion were very similar (Med. Gaz. xli. p. 318:) it was remarked that the mass of blood was darker than natural, and that it was fluid and unusually thin. The muscles were also darker than ordinary.

The vapour of chloroform being more volatile than that of ether, would not be so readily detected in the body by the smell. In Dr. Jamieson's case, the blood had no odour, but the bloody fluids yielded on distillation a small quantity of a volatile liquid, which had a strong chloroform smell. A process for detecting chloroform in the tissues has been suggested, but as it rather detects chlorine, hydrochloric acid or a chloride, and not chloroform, I do not here describe it. It appears to me to be unsatisfactory.

In consequence of the power possessed by this vapour of rendering persons insensible and incapable of offering resistance in assaults with intent to commit rape and other felonies, the using of it for such a purpose has been made a felony by a recent act of Parliament (14 and 15 Vict. ch. 19, s. 3)

NARCOTICO-IRRITANT POISONS.

CHAPTER XIX.

GENERAL REMARKS—NUX VOMICA—STRYCHNIA—COLCHICUM—WHITE HELLEBORE—DIGITALIS—CONIUM MACULATUM—DATURA STRAMONIUM—ACONITE—DEADLY NIGHTSHADE—TOBACCO—COCCULUS INDICUS—LABURNUM—MUSHROOMS—YEW.

THE Narcotico-irritant poisons are derived from the vegetable kingdom. Their *effects* on the body are of a mixed character, since both the brain and alimentary canal are liable to be affected by them.

In order to prove fatal, they require to be exhibited commonly in large doses. The symptoms in most cases appear in about an hour; but sometimes they may be delayed for many hours. This has been especially noticed with regard to poisonous mushrooms. The symptoms commonly observed are vertigo, coma, delirium, paralysis, and convulsions; such, at least, are the effects resulting from Monkshood (Aconite) and deadly Nightshade (Belladonna.) These poisons have in general a strong and well marked taste, so that they cannot be criminally administered without suspicion being excited, or without detection. Murder by monkshood has been accomplished by the criminal substitution of the leaves of this plant for other vegetables at a meal.

The strychnos tribe, including Nux Vomica, has a specific action on the spinal marrow, producing tetanus and convulsions, but rarely coma or delirium. Squills and foxglove (Digitalis) produce symptoms of narcotism, *i. e.* they affect the brain; but these symptoms are commonly preceded by vomiting, with violent pain in the stomach and bowels, indicative of an irritant action.

Thus, then, there is great variety in the effects produced by this class of poisons, and the same may be said of the post-mortem appearances in the bodies of those who have been killed by them. In some instances the stomach and intestines are inflamed; in others not. When the person has died under symptoms of narcotism, traces of cerebral congestion are occasionally found; but cases of fatal poisoning by these vegetable substances are so rare, that we have yet much to learn respecting the morbid changes which they produce.

NUX VOMICA.

Cases of poisoning by nux vomica are not unfrequent. In 1837-8, there were three fatal cases marked in the coroner's return, and one case of poisoning by strychnia. The poisonous properties of nux vomica are due to the presence of *Strychnia;* the symptoms of the two forms of poisoning are alike, but of course much more severe when produced by the pure alkaloid, strychnia. Nux vomica is usually taken in the form of powder.

Symptoms. — The powder has an intensely bitter taste, which is very persistent, and is with difficulty concealed by other substances. In from five to twenty minutes after it has been swallowed, the patient is suddenly seized with tetanic spasms, affecting the whole of the muscular system, the body becoming

rigid, the limbs stretched out, and the jaws so fixed that considerable difficulty is experienced in introducing any thing into the mouth. The muscles of the chest are also fixed by spasmodic contraction, and the body sometimes assumes the state of opisthotonos: the intellect is clear. This spasmodic state ceases, but, after a short interval, reappears, and the chest is so fixed as to give a sense of impending suffocation. After several such attacks, increasing in severity, the patient dies asphyxiated. Drowsiness and a feeling of general illness have sometimes preceded the attack; vomiting, pain in the abdomen, and other symptoms of irritation, have been occasionally witnessed where the case was protracted; but in general, death takes place long before such symptoms are manifested.

Post-mortem appearances.—In a well marked case of poisoning by this substance at University College Hospital in 1839, the only appearances met with were general turgescence of the brain and its vessels. A quantity of the powder was found in the stomach, to the mucous membrane of which it adhered very tenaciously; there was injection, with many ecchymosed points at the cardiac extremity. The brain, as well as the spinal marrow, has been found softened. The spasmodic condition of the body has been observed to continue after death, and to pass into the state of cadaverous rigidity.

Fatal dose.—According to Christison, the smallest dose yet recorded is three grains of the alcoholic extract; but it is not stated to how much of the powder this would correspond. Two cases occurred in London, in 1839, in each of which fifty grains of the powder (equal to about one-fourth of a grain of strychnia,) proved fatal. In one of these cases, death took place in an hour;—the druggist who sold the poison said that he did not think that a dose of fifty grains was sufficient to cause death! but a smaller quantity has been known to destroy life. In a case reported by Hoffmann, and quoted by Christison, (901,) also by Traill, (Outlines, 137,) *thirty grains* of the powder given in two doses of fifteen grains each, proved fatal. The poison was given by mistake to a patient labouring under quartan fever. This is, I believe, the *smallest* fatal dose recorded. In the third edition of this work it was stated, on the authority of Dr. Traill, that fifteen grains had proved fatal; but Dr. Traill informs me that the dose was twice given, thus making thirty grains. This question became of some importance in the case of *Reg.* v. *Wren*, (Winchester Spring Ass. 1851.) The prisoner was convicted of an attempt to administer this poison in milk: the quantity separated from the milk amounted to forty-seven grains. The intense bitterness which the nux vomica gave to the milk led to detection, and this would, in general, be a bar to the criminal administration of this poison or of strychnia, except in the form of pills. Death usually occurs in from one to two hours: but Dr. Christison mentions a case where a man died in *fifteen minutes* after taking a dose. (898.) This is probably the shortest period. There are several instances of recovery on record. Mr. Iliff has reported a case in which a female recovered after taking two drachms of the poison. (Lancet, Dec. 15, 1849.)

Chemical analysis.—Nux vomica is well known as a flat round kernel, less than an inch in diameter, with radiating fibres, slightly raised in the centre. It is of a light brown colour, and covered with a fine silky down. It is very hard, brittle, tough, and difficult to pulverize. The powder is of a gray brown colour like that of liquorice: it is sometimes met with in a coarsely rasped state: it has an intensely bitter taste. It yields to water and alcohol, strychnia, brucia, igasuric or strychnic acid, and some common vegetable principles. Heated on platina-foil, it burns with a smoky flame. Nitric acid turns it of a dark orange-red colour, which is destroyed by protochloride of tin. In one case of poisoning by this substance, (*Reg.* v. *Wren*,) I found a quantity of guaiacum powder mixed with the nux vomica. This so completely changed the action of nitric acid as in the first instance to create some difficulty in identifying the substance. The analyst must be prepared for these adulterations.

The aqueous *infusion* is similarly changed by nitric acid, and it is freely pre-

cipitated by tincture of galls. The quantity of strychnia contained in the powder has not been very accurately determined. It probably amounts to 0·5 grain or one-half grain per cent. If this be the case, the strychnia is more energetic when contained in the nut, than when separated.

Strychnia and its Salts.

The *symptoms* produced by strychnia closely resemble those described in speaking of nux vomica. The following case is reported in the Lancet, (Jan. 7, 1838.) A young man, aged seventeen, swallowed forty grains of strychnia. The symptoms came on in about a quarter of an hour; lock-jaw and spasmodic contraction of all the muscles speedily set in, the whole body becoming as stiff as a board; the lower extremities were extended and stiff, and the soles of the feet concave. The skin became livid, the eye-balls prominent, and the pupils dilated and insensible; the patient lay for a few minutes without consciousness, and in a state of universal tetanus. A remission occurred, but the symptoms became aggravated, and the patient died asphyxiated from the spasm of the chest, in about an hour and a half after taking the poison. On inspection, twenty hours after death, the body was very rigid. There was effusion in the spinal sheath, and the upper part of the spinal marrow was softened; the brain was congested, but the alimentary canal was in its normal state.

The *quantity* of strychnia required to destroy life is very small. The *smallest* fatal dose was in the case of Dr. Warner, who died from the effects of *half a grain* of sulphate of strychnia in about *fourteen minutes*. In a case communicated to the Lancet (Aug. 31, 1850, p. 259) by Mr. Bennett, *one grain and a half*, taken by mistake, destroyed the life of a healthy young female in an hour and a half. It is remarkable that no symptoms appeared for an hour. They first consisted in spasmodic twitchings of the limbs, with general tremors. When seen at this time there were paroxysms, in which the limbs were rigid, and the jaw was completely fixed, the whole body stiffened and straightened; and in one of these fits the girl died. It was remarked that during the fit the pupils were dilated, but after it had passed off they became contracted. When this poison proves fatal, it generally destroys life within two hours. In a case which occurred in October, 1848, *nine grains* of strychnia were dispensed in a mixture by mistake, in place of *salicine*. A part only of the mixture was taken, and the patient died in less than two hours. (See Med. Gaz. vol. xlii. p. 797.) There is one case reported in which a person is stated to have recovered from a dose of *seven grains*. (Med. Gaz. xli. 305.)

Recovery from a large dose of strychnia.—I am indebted to Mr. J. C. Forster for the subjoined account of a case showing the effects produced by *a grain* of strychnia on an adult. It occurred in May, 1852. S. J., æt. 52, a dissolute hypochondriac, with a constitution and intellect considerably damaged, was under Mr. Forster's care for indolent ulcers on both legs, and on account of dyspeptic symptoms, from which he also suffered. He ordered him one-twelfth of a grain of strychnia, to be taken three times a day. For convenience and accuracy in dispensing, an acid solution of strychnia is kept at the Surrey Dispensary, in the proportion of *one grain to an ounce of water*, and this patient had one ounce and a half of that solution given to him, a teaspoonful of which contained the dose required. From inattention to both verbal and printed instructions, on his return home he took rather more than an ounce of the medicine, which he had not swallowed above *ten minutes* when he became violently convulsed. On discovering his mistake he immediately took copious draughts of cold water, but the convulsions increasing in severity his friends became alarmed, and he was taken to a hospital, where, being refused admittance, he was again brought to the Dispensary. An hour and a half had now elapsed since the poison was taken, during the whole of which time his attendant stated he had been violently convulsed. When Mr. Hills first saw him he had lock-jaw, with the upper and

lower extremities completely rigid, and paroxysms of opisthotonos and emprosthotonos occurring alternately. A paroxysm now took place every six minutes, each one lasting about two minutes, and during the emprosthotonic condition he uttered a violent shriek. He had half a drachm of sulphate of zinc given immediately, and was sent home and placed in a warm bed. Mr. Forster saw the patient with Mr. Hills about four hours after the poison had been taken, and found that he had been slightly emetized by the zinc, and had also been most violently purged. The tetanic rigidity still continued; the paroxysms were, however, less frequent; the patient could only lie on his back, and the slightest exertion brought on the convulsive attacks. The bladder also seemed to participate in the general contraction of the voluntary muscles, and expelled small quantities of urine as fast apparently as it flowed into that organ; the pupils were natural; the pulse small and irritable; and the whole frame was evidently much exhausted and enfeebled. He was now ordered frictions over the spine by means of soap liniment, which afforded him great relief, and half a drachm of the compound spirit of sulphuric ether in camphor mixture to be taken internally every four hours. During the night he continued to have involuntary twitchings of the limbs, which lasted also through the following day; on the second night they became more severe, but were of only a few hours' duration, and then entirely left him. He has since returned to his work in his usual health.

Although strychnia is a poison which has been hitherto considered to be beyond the reach of the common class of criminals, it has of late been employed for poisoning vermin and game in certain districts. It may thus find its way into the hands of persons as a substitute for arsenic. A trial for murder by strychnia administered in pills took place in 1851 in Canada. Suspicion was excited from the nature of the symptoms and the rapidity of death. There was no direct proof of the administration, and the jury acquitted the prisoner. For the details of this interesting case, see British American Journal, July, 1851; and Med. Gaz. vol. xlviii. p. 517. (Case of *Azenath Smith.*)

COLCHICUM. (MEADOW SAFFRON.) COLCHICINA. WHITE HELLEBORE. VERATRIA.

The roots and seeds of these plants, and the leaves and flowers of colchicum, exert a violent action on the human subject, chiefly manifested by symptoms of irritation in the alimentary canal. With a burning pain in the throat and œsophagus, there have been violent vomiting and purging, and death in the course of some hours. After death, the stomach has been found inflamed, but not in all instances. In November, 1839, a gentleman swallowed by mistake one ounce and a half of wine of colchicum. He was immediately seized with severe pain in the abdomen: other symptoms of irritation came on, and he died in seven hours. No post-mortem examination was required by the coroner! In another instance in which an ounce was taken, death occurred in thirty-nine hours. (Schneider's Annalen, i. 232.) In a well marked case of poisoning by the wine of colchicum, reported by Mr. Faraday, two ounces were taken. The symptoms did not come on for an hour and a half; there was then copious vomiting of a yellow fluid, severe pain with great tenderness in the abdomen, tenesmus, and thirst. The patient died in forty-eight hours, without manifesting any sign of cerebral disturbance. The chief morbid appearance was a patch of redness in the mucous membrane of the stomach, near the cardiac orifice; the intestines were slightly inflamed. In another case, where an ounce and a half of the tincture was taken, and death ensued in forty-eight hours, no morbid appearances were found. A man, aged fifty-two, took a decoction, made with a table-spoonful of colchicum seeds to a pint and a half of water. He was seized with vomiting and purging, continuing incessantly until death, which took place in about thirty-six hours. The only appearance of note was that the stomach had

a violet or purple hue. In one instance a person recovered after swallowing an ounce of the tincture. There were cramps in the limbs and twitchings in the tendons. (L'Union Méd. Aug. 24, 1848.) An interesting case of poisoning by the medicinal administration of colchicum has been communicated to me by Mr. Mann, of Bartholomew Close. Three and a half drachms of the wine of colchicum were taken in divided doses, and caused death on the fourth day. There was no inflammation of the mucous membrane, but simply extravasation of blood in the mucous follicles.

A decoction of *Hellebore* is a popular remedy for worms in some parts of the country. When thus administered to children, it has in several instances caused convulsions and death. It is in all cases a dangerous substance in the hands of the ignorant.

Digitalis. (Foxglove.) Digitalia.

This plant, whether in the form of powder, extract, tincture, or infusion, is a poison, acting both on the brain and alimentary canal. The leaves appear to have the most powerful effect. One of the best marked cases of poisoning by this plant became the subject of a criminal trial at the Old Bailey in Oct. 1826. A quack was indicted for the manslaughter of a boy under the following circumstances:—He prescribed for a trivial complaint six ounces of a strong decoction of digitalis. The boy was soon attacked with vomiting, purging, and severe pain in the abdomen. After some time, he became lethargic, and slept for several hours; in the night he was seized with convulsions. The pupils were dilated and insensible, the pulse slow, small, and irregular; coma followed, and the boy died twenty-two hours after the taking of the poison. On inspection, the membranes of the brain were found much injected, and the mucous lining of the stomach was partially inflamed. The prisoner was acquitted of the charge, because he had only given his advice on the application of the friends of the deceased! (Ed. Med. and Surg. Jour. xxvii. 223.) For cases of recovery from a strong dose of the infusion, see Med. Gaz. xxxiv. 659; and L'Union Médicale, 24 Août, 1848. On the other hand, a case in which an infusion of the root proved fatal will be found in the Lancet, July 14, 1849, p. 31. Accidents sometimes occur from the medicinal use of the tincture. In a late number of the Medical Gazette is the account of a case where, from a dose of the tincture too frequently repeated, the person was attacked with restlessness, thirst, inflamed conjunctivæ, and other serious symptoms. The medicinal dose of the infusion is from half an ounce to one ounce,—of the tincture, from ten minims to forty,—of the powder, from half a grain to one grain and a half.

Conium Maculatum. (Common Hemlock.)

The leaves and roots of this plant, in common with those of the *Cicuta Virosa* (Water Hemlock,) *Æthusa Cynapium* (Fool's Parsley), *Œnanthe Crocata* (Hemlock Water-dropwort), have frequently given rise to accidents. The symptoms which they produce are dimness of sight, vertigo, delirium, swelling with pain in the abdomen, vomiting, and diarrhœa. Convulsions are sometimes observed. Death commonly takes place rapidly, and the post-mortem appearances are slight, sometimes amounting merely to congestion of the brain, with slight inflammatory redness of the stomach and bowels. The *Œnanthe crocata* appears to be the most fatal among these plants. In February, 1834, four convicts at Woolwich lost their lives by eating the roots of this vegetable, which they had mistaken for parsnips. One died in less than an hour. (For an account of these cases, see Med. Gaz. May, 1844.) On inspection, their stomachs were found completely filled with slices of the root. Ten others who had also partaken of the root suffered severely, but recovered. This is one of the most virulent of English vegetable poisons. It is found growing abundantly in the

South of Ireland. Dr. Pickells has collected thirty cases of death from the eating of the root,—the quantity taken in one instance did not exceed the top of the finger in size. The symptoms were insensibility, tetanus, delirium, and insanity. Dr. Christison states that he has not found this plant, as it grows in Scotland, to be poisonous; but it is an active poison as it grows in England, Wales, and Ireland. The following is a case of poisoning by the *Æthusa cynapium*, reported in a late number of the Medicinisches Jahrbuch. A woman gave two of her children some soup in which she had boiled the root of this plant, mistaking it for parsley. They were both seized with severe pain in the abdomen, and the next morning one of them, a boy aged eight years, was in a state of perfect unconsciousness, and his jaws were spasmodically fixed. The abdomen was swollen; there was vomiting of bloody mucus, with obstinate diarrhœa,—the extremities were cold, and the whole body was convulsed. He died in twenty-four hours. The only appearances met with were redness of the lining membrane of the œsophagus and trachea, with slight vascular congestion of the stomach and duodenum. For a very interesting case of poisoning by Conium, by Dr. Bennett, I must refer the reader to the Ed. Med. and Surg. Journal, July, 1845, p. 169. (See also, ON POISONS, 752.) And the reader will find some important remarks on its active principle, CONIA or CONICINE, by Orfila, in the Annales d'Hygiène, 1851, ii. 224.

It is rare that the question of poisoning by hemlock comes before a judicial tribunal. One case of this kind was, however, submitted to me in 1848. (*Rex* v. *Bowyer*, Ipswich Summer Ass. 1848.) In this instance a child died in an hour after swallowing part of a tea-cupful of a decoction of hemlock, alleged to have been administered by the mother. The woman was acquitted for want of proof. There were no morbid appearances in the stomach, nor any trace of hemlock leaves in the stomach or bowels.

DATURA STRAMONIUM. (THORNAPPLE.) DATURIA.

The following case, reported by Mr. Mash of Northampton, may be taken as an example of the effects produced by this plant, all the parts of which, but especially the seeds and fruit, are poisonous. A woman, aged thirty-six, took two tea-cupfuls of infusion of stramonium, by mistake for senna-tea. In about ten minutes she was seized with dimness of sight, giddiness, and fainting. In two hours she was quite insensible, the pupils were fixed and dilated; all the muscles of the body convulsed, the countenance flushed, and the pulse full and slow. The stomach-pump was applied, and in the course of a few hours she recovered, suffering, however, from indistinctness of vision and vertigo. (Med. Gaz. viii. 605.) The seeds of this plant have been known to produce furious delirium; and a case is mentioned by Sauvages of an old man of sixty, who, after taking this poison, became intoxicated, maniacal, and lost the power of speech. He remained in a lethargic state for five hours. Several fatal cases are reported, one of which terminated in six hours. Dr. Thomson relates the case of a child, aged two years, who swallowed sixteen grains of the seeds. Maniacal delirium supervened; the symptoms resembled those of hydrophobia, and death took place in twenty-four hours. This plant has been used by robbers for the purpose of stupifying those whom they intend to attack. A very interesting medico-legal case of poisoning by thornapple will be found reported in Henke's Zeitschrift der S. A. 1837, i. H.; and another in the Lancet, April, 1845, 47. Dr. Zechmeister has reported the case of a boy, aged five years, from which it would appear that the vapour of the full-blown flowers is capable of giving rise to well marked symptoms of poisoning. (Oesterreich. Med. Wochenschr. 19 Juli, 1845.) Other cases of poisoning by stramonium will be found in the Prov. Journal, Dec. 24, 1851, p. 699; and Lancet, May 31, 1851, 599.

ACONITUM NAPELLUS. (MONKSHOOD. WOLFSBANE. BLUE-ROCKET.)
ACONITINA.

Two deaths are recorded to have taken place from this poisonous plant in 1837-8. The root, seeds, and leaves, contain a most active poison, *Aconitina*, to which the properties of the plant are due. These parts of the plant possess a hot acrid taste, and give rise to a burning sensation in the fauces, numbness and tingling in the limbs, swelling and pain in the abdomen, vomiting and diarrhœa, accompanied by vertigo, delirium, dimness of sight, and other symptoms indicative of cerebral affection. In 1842, a lady, residing in Lambeth, was poisoned by her having eaten the root in mistake for horse-radish with some roast beef. It is not likely that, under these circumstances, much could have been eaten; but very shortly after dinner slight vomiting came on, with severe pain in the abdomen. Emetics and the stomach pump were used, but she died in three hours.

In the hospital at Bordeaux, *five grains* of fresh extract of aconite were given to three patients. One of them died in three hours. In a quarter of an hour after taking the poison, the patients had tremors of the muscles, and a pricking sensation over their bodies; severe vomiting followed. They became quite unconscious; and on recovering their senses there was confusion of sight, with intense headache; the skin was cold and clammy, the pulse slow and irregular, and the respiration short and hurried. Two of the patients recovered. (Med. Chir. Rev. Oct. 1839, 544.) One drachm of the root is said to have proved fatal; but it is probable that less than this would suffice to kill an adult. There appears to be considerable uncertainty in the operation of this poison under the form of tincture. In a case which occurred to M. Devay (Cormack's Edinburgh Journal, April, 1844,) a man recovered in three days after having taken upwards of ten drachms of the tincture (only infused for a day;) while the late Dr. Male of Birmingham is reported to have died from the effects of not more than eighty drops taken in ten doses, over a period of four days,—the largest quantity taken at once being *ten* drops. (Prov. Med. and Surg. Journ. August 20, 1845, p. 535; also Med. Gaz. xxxvi. 861.) Dr. Pereira informs me that he has known general numbness produced in hysterical females by a dose of only *five minims* of a carefully prepared tincture. Dr. Topham has recently communicated to the Lancet an interesting account of the symptoms produced by only *fifteen minims* of the tincture of the root of aconite. Immediately after taking the poison in a mixture into which it was put by mistake, the patient (a woman aged twenty-seven) felt a sensation of numbness in the tongue, with difficulty of swallowing. There were convulsive twitchings of the muscles of the face, and she lost the power of walking. There was complete unconsciousness, which continued for two hours, when she began to recover. The pupils were observed to be slightly contracted. The intensity of the symptoms varied at intervals, and came on in paroxysms. They indicated great disorder of the nervous system. The next day she had numbness in both arms, but she rapidly and perfectly recovered. (Lancet, July 19, 1851, p. 56.) [A case recently occurred in the neighbourhood of Philadelphia, in which death rapidly ensued from the administration by mistake of a tablespoonful of the saturated tincture. The victim in this instance had been confined to bed for some days by neuralgic disease, for which the tincture had been externally applied. Another case is reported by Dr. McCready of New York, in which a tablespoonful of the saturated tincture was swallowed by a healthy Irish woman æt. 25. An emetic was taken about an hour after the poison, and a pint of thick fluid, consisting chiefly of partially digested food, ejected. Presence of the tincture therein not ascertained. She complained of numbness and tingling of tongue and whole surface of body. Pulse 120, soft, feeble and varying in force. No nausea except from emetic, head perfectly clear, and pupils *dilated*. (Am. Journ. Med. Sci. Jan. 1852, 268.)—H.]

The alkaloidal base of this plant, *Aconitina*, is a most formidable poison,

exceeding all others in its effects; according to Dr. Pereira, it is strongly retained in the vegetable tissues after their compression. Hence the uncertainty of the strength of the preparations of aconite.

Although there are few poisons so deadly as aconitina,—for even experiments on it require to be made with the greatest caution,—a singular instance is recorded by Dr. G. Bird, in which a gentleman recovered after having taken *two grains and a half*. (Med. Gaz. vol. xli. p. 30.) In this case, however, there appears to have been early and copious vomiting, so that the greater part of the poison had probably been discharged. Enough had been absorbed, however, to produce most serious symptoms. There was collapse, coldness of surface, cold perspiration, heart's action scarcely perceptible, and constant spasmodic vomiting of a very violent kind.

Atropa Belladonna. (Deadly Nightshade.) Atropia.

This plant is poisonous in its root, leaves, and berries. Children have frequently suffered severely from eating the shining black berries of the belladonna. The symptoms observed have been heat and dryness of the throat and fauces,—vertigo, double vision, with delirium, convulsions, sopor, and lethargy; sometimes nausea and vomiting. The pupils are much dilated, and the eyes are insensible to light. On inspection, the vessels of the brain have been found turgid with dark-coloured blood. Several deaths from the effects of the berries occurred in this metropolis in the autumn of 1846. Dr. Scharf has published a case of poisoning by the root of belladonna infused in four ounces of water and injected as a clyster. In a very short time the patient fell into a state of complete narcotism, and died in five hours. (Casper's Wochenschrift, February, 1845.) Mr. Iliff, Jun., gives an account of the effects produced on himself by a dose of nine grains of the extract of belladonna, for which I must refer to the Lancet (Dec. 1, 1849, p. 756. See also Med. Times, Aug. 30, p. 234.) In the Medical Gazette (vol. xlii. p. 589,) will be found the report of an inquest in a case of alleged poisoning by belladonna, involving many interesting points regarding this poison. The extract of belladonna is no doubt subject to great variation in strength, and this may explain certain exceptional cases in which persons have recovered after having taken large doses of this compound. Mr. Edwards has reported a very interesting case in which a female, æt. 34, recovered after having swallowed a drachm of the extract by mistake. (Lancet, May 24, 1851, p. 568.)

The alkaloidal principle of this plant, *Atropine*, [Atropia] is a powerful poison. In November, 1850, Mr. Sells, of Guildford, forwarded to me for examination the stomach of a young man who had poisoned himself by taking two grains of atropine. He took the dose on going to bed. He was heard to snore heavily through the night, and was found dead about seven o'clock in the morning, lying on his right side, the surface livid, the limbs rigid and contracted, and with a little brown matter issuing from the mouth. The pupils were much dilated. The mucous membrane of the stomach presented a diffused redness which might have arisen from some brandy which he had swallowed. No trace of the poison could be detected in the stomach or its contents. [An instance of the poisonous effects of a *solution* of atropia (5 centigr. in thirty grammes—nearly one grain in an ounce—of water acidulated with acetic acid) applied to the conjunctiva in a case of double cataract, is reported in the Abeille Médicale (25 Jan. 1853, 29) to have occurred in the service of M. Chassaignac at the Hospital St. Antoine, Paris. Half an hour after the instillation of three or four drops in each eye the patient was attacked with violent symptoms of poisoning by belladonna, which did not entirely subside until three or four days had elapsed.—H.]

Nicotiana Tabacum. (Tobacco.)

This plant, according to late researches, contains a poisonous volatile alkaloidal principle, *nicotina*, which forms from two to seven per cent. of tobacco. It is a

colourless oleaginous liquid of a powerful tobacco odour, hot acrid taste, and soluble in alcohol, water, and ether. It has a strong alkaline reaction. A remarkable case of poisoning by nicotina will be found in the Annales d'Hygiène, 1851, p. 167: I allude to that of the *Count Bocarmé*, who was tried and executed in Belgium for the murder of his brother-in-law. Tobacco has proved fatal, when used improperly or by mistake, in the form of an injection, but very little is known concerning the few cases in which it has destroyed life. The symptoms have been nausea, vomiting, vertigo, convulsions, and coma, followed by death in a few hours. In one case it destroyed life in three-quarters of an hour. One of the best observed cases of poisoning by tobacco has been reported by Mr. Eade. A girl, æt. 18, injected as a clyster a decoction made by boiling *three drachms* of common shag tobacco in a pint of water. In half an hour she complained of faintness and feeling sick, and in another half hour she became quite collapsed, with cold sweats, vomited, was slightly convulsed, and died in an hour and a half from the time at which she injected the clyster. On inspection, the heart was found very flaccid; there were three drachms of fluid black blood in the ventricles. The stomach contained food, but had no unusual appearance. The intestines presented no trace of inflammation or redness in any part, and there was no smell of tobacco (thirty-six hours after death) either in the intestines or in any part of the body. The head was not examined. (Med. Gaz. xliv. p. 823.) These facts tend to show that tobacco is rather a narcotic than a narcotico-irritant poison.

Lobelia Inflata.

The powdered leaves of Indian tobacco (*Lobelia Inflata*) contain an acrid principle which is capable of producing narcotico-irritant effects. As a poison it is but little known in this country. Wibmer relates that in one instance it produced at first violent vomiting in the person for whom it was prescribed; but the medicine was repeated until it was no longer ejected from the stomach. The patient suffered severe pain, and speedily died: stupor and convulsions having preceded death. The powdered leaves and seeds are much employed by quacks in the United States; and accidents occasionally arise from the substance being prescribed in excessive doses. When administered in doses of from ten to twenty grains, lobelia acts as an emetic; but in larger quantity it acts deleteriously. It would also appear that even ordinary medicinal doses affect some individuals with great severity; owing, probably, to idiosyncrasy.

A case has recently occurred, in which a man lost his life by swallowing *one drachm* of the powdered leaves, prescribed by a quack. This person was seen by a medical practitioner soon after he had taken the poison; he was evidently suffering great pain, but he was quite unconscious,—the pulse small, the pupils strongly contracted and insensible to light. He had vomited the greater part of the poison. He suffered from spasmodic twitchings of the face, sank into a state of complete insensibility, and died in about thirty-six hours. On inspection, some fluid was found in the stomach, but none of the powder. The mucous membrane was intensely inflamed, and the vessels of the brain were strongly congested. (Pharm. Times, May 1, 1847, p. 182.)

Since the third edition of this work appeared, there have been several trials for manslaughter in this country as a result of the administration of the leaves of the *Lobelia Inflata* by ignorant quacks. The medical evidence given on these trials shows that it is a most noxious drug. (See Medical Gazette, vol. xliv., pp. 383 and 433, also vol. xlvi. p. 384, and for some valuable remarks on the action of the poison see a paper by Mr. Curtis and Dr. Pearson, Med. Gaz., vol. xlvi. p. 285, and vol. xlvii. p. 160.)

Cocculus Indicus.

This is the fruit or berry of the Menispermum Cocculus, imported from the East Indies. It contains from one to two per cent. of a poisonous alkaloid

Times, June 10, 1848, p. 88.) These and other cases show that [redacted] not be regarded as a very active poison. (Wibmer, op. cit. iii. 21[redacted] experiments on animals, the mucous membrane of the stomach [redacted] flamed (ii. 493.)

In a series of cases reported by Dr. Schaaf, the symptoms [redacted] were those of a narcotico-irritant poison. A woman gave a tabl[redacted] grains) of powdered camphor to three of her children as a verm[redacted] the children were respectively of the ages of three and five yea[redacted] an infant aged eighteen months. The first symptoms were pallo[redacted] fixed and stupid look. Delirium followed, with a sense of bu[redacted] and great thirst. Vomiting, purging, and convulsions super[redacted] child the convulsions were most violent. The two elder ch[redacted] thus for three hours, fell into a comatose sleep, and on a[redacted] passed off. The infant died in seven hours, not having r[redacted] consciousness from the first occurrence of convulsions. [redacted] 219.) The severity of the symptoms is fully explained [redacted] administered to these young subjects. In a dose of [redacted] clyster, camphor produced alarming symptoms. (Med [redacted]

Alcohol.

Symptoms.—A large quantity of spirit has been [redacted] ily, although such a case is rare. Orfila mentions an [redacted] died immediately from the effects of a large dose o[redacted] In general, the symptoms come on in the course [redacted] confusion of thought, with inability to stand or [redacted] tigo, followed by coma. Should the individual [redacted] and sickness supervene. This form of poisoni[redacted] lies:—thus the insensibility may come on sud[redacted] Christison met with a case where the indivi[redacted] some time after he had swallowed sixteen [redacted] the usual premonitory symptoms. In an[redacted] recover from the first effects, then sudden[redacted] Convulsions are, however, by no means [redacted] alcohol. Orfila makes their absence [redacted] by alcohol and opium (Op. cit. ii. 550.[redacted] twice out of many cases: the subjects [redacted] poisoning by alcohol, the supervention [redacted] as to prevent an individual from perfor[redacted] The more concentrated the alcohol, t[redacted] and they are then more severe in th[redacted] produces the stage of excitement bef[redacted] trated alcohol there may be profound [redacted] indicate an action by sympathy on the [redacted] in a condition most favourable to absor[redacted] its *vapour*. If the concentrated vapour [redacted] effects of intoxication. It is generally [redacted] the first time employed in bottling spirit[redacted] vapour. There is a case on record in wh[redacted] into an apoplectic stupor by the alcohol[redacted] way a child might be destroyed, and n[redacted] stomach.

Post-mortem appearances.—In resp[redacted] has been found inflamed—the mucous[redacted] bright red, and in another of a dark re[redacted] place rapidly, there will be a strong od[redacted] may not be perceived if many hours ha[redacted]

laburnum flowers, is described by Mr. North in the Medical and Physical Journal, vol. lxii. page 86.

Fungi. Mushrooms.

Poisoning by mushrooms is by no means unusual as the result of accident. In 1837-8 there were four fatal cases of this description. There do not appear to be any satisfactory rules for distinguishing the mushrooms which are wholesome from those which are poisonous. The best test is that assigned by Dr. Christison—namely, that the *poisonous* vegetable has an astringent styptic taste; and perhaps also a disagreeable but certainly a pungent odour. The narcotic poisonous principle is called *Fungin*, but its nature and properties are but imperfectly known. These fungi act sometimes as narcotics, at others as irritants. [It has been recently ascertained by M. Gérard, that the mushroom may be deprived of its noxious property by prolonged maceration in acidulated water, (Am. Jour. Med. Sci., Jan. 1853, 261.)—H.] It is difficult to generalize where observations are so limited; but it would appear from the reports of several cases which I have collected, that when the narcotic symptoms are excited, they come on soon after the meal at which the mushrooms have been eaten, and they are manifested by giddiness, dimness of sight, and debility. Dr. Peddie has related three cases of poisoning by mushrooms, in which the poison acted as a pure narcotic: there was no pain in the abdomen, nor irritation in the alimentary canal (Ed. M. and S. J. xlix. 200.) The narcotic symptoms began in half an hour with giddiness and stupor. The first effect with one patient was, that every object appeared to him to be of a blue colour. The three patients recovered, two of them rapidly. When the drowsiness passes off, there are generally nausea and vomiting. If the symptoms do not occur until many hours after the meal, they partake more of the characters of irritation;—indicated by pain and swelling of the abdomen, vomiting and purging. Several cases, in which the symptoms did not appear until after the lapse of fourteen hours, are reported in the Medical Gazette, (vol. xxv. p. 110.) In some instances the symptoms of poisoning have not commenced until after the lapse of thirty hours; and in these, narcotism followed the symptoms of irritation. It might be supposed that these different effects were due to different properties in the mushrooms; but the same fungi have acted on members of the same family, in one case like irritants, and in another like narcotics. In some persons, even the edible mushrooms will produce disorder of the stomach and bowels by the effect of idiosyncrasy. In most of these cases recovery takes place, especially if vomiting be induced: in the few instances which have proved fatal, there has been more or less inflammation in the stomach and bowels, with turgescence of the vessels of the brain. Reports of recent cases of death from mushrooms will be found in the Medical Gazette, vol. xlvi. p. 307, and xlvii. p. 673. Even *Catsup*, a liquor made from mushrooms, has been known to produce serious effects. (Dub. Med. Press, Sept. 24, 1845, p. 195.)

Yew.

It has long been known that the berries and leaves of the yew-tree (Taxus baccata) are poisonous to cattle;—they act very energetically, and produce death in a few hours, sometimes without vomiting or purging. It is stated by Dr. Percival, that a table-spoonful of the *fresh leaves* was administered to three children of five, four, and three years of age, as a vermifuge. Yawning and listlessness soon succeeded; the eldest vomited a little, and complained of pain in the abdomen, but the other two suffered no pain. They all died within a few hours of each other. An interesting case of poisoning by the *berries* of this tree was published a few years since by Mr. Hurt, of Mansfield. A child, aged three years and a half, ate a quantity of yew-berries about eleven o'clock. In an hour afterwards the child appeared ill, but did not complain of any pain. It vomited part of its dinner, mixed with some of the berries. A medical man

was sent for, but the child died in convulsions before he arrived. On inspection, the stomach was found filled with mucus and the half-digested pulp of the berries and seeds. There were patches of redness in the mucous membrane, and this was so much softened that it could be detached with the slightest friction. The small intestines were also inflamed.

The symptoms produced by yew-leaves and berries are pretty uniform in character: convulsions, insensibility, coma, dilated pupils, pale countenance, small pulse, and cold extremities, are the most prominent. Vomiting and purging are also observed among the symptoms. In two cases of recent occurrence, the subject of one—a girl, about five years of age, died in a comatose state in four hours after she had eaten the *berries*, and of the other, a boy, aged four years, died nineteen days after taking the berries, obviously from severe inflammation of the bowels (see Prov. Journal, Nov. 29, 1848, 662, and Dec. 27, p. 708.)

There is a vulgar but erroneous notion that the yew-leaves are not poisonous when fresh, and that in any case they act only mechanically. A case related above shows the fallacy of the opinion, and the other cases prove that there is a specific poison in the yew, since it exists in the berries. If cattle recover from the primary effects on the nervous system, they are liable to die after several days, from inflammation of the bowels. I lately examined the viscera of an ox which had obviously died from the effects of yew-leaves. In some parts of the intestines gangrene had taken place.

[Many other plants indigenous to the U. S. are possessed of narcotico-acrid properties: none of them with the exception of *Cicuta maculata* require notice. The cicuta is exceedingly active and prompt in its operation. Many cases of death are recorded, in almost every instance from eating the root in mistake. The symptoms are analogous to those caused by other articles of the class, except that pain and convulsions are sometimes wanting.

The following list given in the previous American edition includes most of our native poisonous plants, in addition to those already noticed, and is mainly taken from Dr. Beck, (ii. 883.)

Sanguinaria canadensis.—*Vid.*	Tully, Med. Rec., xiii. 1. Barton, Veg. Mat. Med. i. 31.
Dirca palustris.	Rafinesque, Med. Flor. i. 160.
Robinia pseudo-acacia.	Phil. Journ. Pharm. vi. 285.
Æsculus ohioensis.	Short, Transylvania Journ. i. 422.
Æsculus pavia.	Torrey & Gray, Flora. N. America, i. 252.
Melia azederach.	Amer. Journ. Pharm. i. 180.
Gelsemium nitidum.	Boston Med. & Surg. Journ. vii. 117.
Kalmia latifolia.	Bigelow, Med. Botany, i. 137.
Spigelia marilandica.	Barton, Veg. Mat. Med. ii. 80.
Helonias erythrosperma.	Boston Med. & Surg. Journ. vii. 136.
Symplocarpus fœtida.	Barton, Veg. Mat. Med. i. 128. Am. Jour. Pharm. i. 1.
Podophyllum peltatum.	Barton, Veg. Mat. Med. ii. 14. Jour. Phil. Col. Pharm. iii. 273.
Euphorbia corollata.	Amer. Journ. Med. Sci. xii. 76.
Rhus radicans, &c.	Caldwell, Med. Theses, i. 128.
Phytolacca decandra.	Barton, Veg. Mat. Med.
Actæa alba et rubra.	Amer. Journ. Pharm.
Apocynum androsæmifolium.	Amer. Journ. Med. Science.—H.]

WOUNDS.

CHAPTER XX.

VARIOUS SURGICAL DEFINITIONS OF A WOUND—INJURY TO THE SKIN—LEGAL DEFINITION—AN ABRASION OF THE CUTICLE NOT A WOUND—IMPLIES IMMEDIATE AND NOT REMOTE LACERATION OF THE SKIN—IS A DISLOCATION A WOUND?—WOUNDS DANGEROUS TO LIFE—THE DANGER IMMINENT—WOUNDS PRODUCING GRIEVOUS BODILY HARM. INTENT OF THE ACCUSED A QUESTION FOR THE JURY.

WHEN a person is the subject of a wound or external injury, from the effects of which he ultimately recovers, a medical witness is often rigorously examined with respect to the precise nature of the injury, and how far it involved a risk of life. The answers to these questions may have an important influence on the defence of a prisoner, when the crime is charged under particular forms of indictment.

Definition of a wound.—It may, I think, be safely asserted, that we shall look in vain for any consistent definition of a wound, in works on medicine and surgery. A wound is, perhaps, most commonly defined to be, a "recent solution of continuity in the soft parts, suddenly occasioned by external causes." Yet they who adopt this view do not regard as wounds ruptures of the liver or spleen, burns by heated bodies, or simple dislocations and fractures; although all of these injuries are comprehended in the literal signification of such a definition. The following definitions of a wound have been furnished to me by three eminent surgeons of this metropolis:—

"A solution of continuity from violence of any naturally continuous parts."

"An external breach of continuity directly occasioned by violence."

"An injury to an organic texture by mechanical or other violence."

Owing to the unsettled meaning of the word *wound*, it has happened on more than one occasion, that medical witnesses have differed in their evidence; and some difficulty has arisen in the prosecution of criminal charges. It has been asserted, that in order to constitute a wound, the *skin* should always be *broken* or injured; and this, as we shall see presently, is the interpretation commonly put upon the term by our judges. But those who have adopted this view do not regard *burns*, produced either by heated metals, or corrosive liquids, as wounds; although there seems to be no good reason why, under the above definition, they should be excluded. Technical difficulties of this kind, which only lead to the embarrassment of witnesses and to the acquittal of prisoners charged with serious offences, might be avoided if the medical witnesses of England were allowed to adopt the comprehensive definition sanctioned by the legal tribunals of certain States on the Continent, namely, that "a wound includes every description of personal injury, arising from whatever cause, applied externally." It may appear contrary to propriety to designate a contusion or fracture as a wound; but the common definitions will be found, on examination, to be equally inconsistent, and to be attended, in legal medicine, by evil results, inasmuch as

they lead to acquittals, not upon the merits of the case, but upon the most trivial pretences. This could not happen if the above comprehensive signification were generally followed. It appears to me, that in a case of this kind we should rather regard the wants of justice than the rules of surgery. If medico-legal cases fail from differences respecting the meaning of scientific terms among surgical writers, it is time that some fixed rule should be adopted. While the science of surgery cannot possibly suffer by such an innovation, the administration of the law will be rendered much more efficient. It is probable that the new Statute, the 14 and 15 Vict. ch. 100, will supply a remedy for some of the evils which have hitherto arisen from a misdescription of personal injuries in indictments.

Legal definition.—It cannot be denied that an alteration in the use of medical terms must, in order to be attended with any good effects, receive the support of our legal authorities. This, probably, would not be long withheld, if good reasons for the change were afforded by medical witnesses. The present rule appears to be, that *no injury constitutes a wound in law, unless the continuity of the skin be broken;* so that in a case where blows were inflicted with a hammer or iron-instrument sufficient to break the collar-bone, and violently bruise but not break the skin, it was held not to be a wounding within the statute. (Archbold.) The Act 1 Vic. c. 85, has in some measure provided for the punishment of persons guilty of inflicting such severe injuries, but still it has left the legal signification of the word wound unsettled. The 14 and 15 Vic. ch. 100, is still more precise, but avoids the definition of a wound. From several recent decisions, it appears that an *abrasion of the cuticle* only, is not to be understood as a breaking of the continuity of the skin,—the cutis or true skin must participate in the injury, and probably the cellular membrane beneath. A man was tried at the Central Criminal Court in August, 1838, on a charge of cutting and wounding the prosecutor. The prisoner struck the prosecutor a severe blow on the temple with a heavy stone-bottle, which was thereby broken to pieces. The prosecutor fell senseless, and it was a long time before he recovered from the effects of the violence. The medical witnesses in this case underwent a rigorous cross-examination by the prisoner's counsel, respecting the meaning of the word "wound." They said that there had been a separation of the *cuticle* or outer skin of the temple, although there was no absolute wound in the usual acceptation of the word. They further deposed that the prosecutor had lost the sight of his left eye, and the hearing of his left ear; and he was for a considerable time in a state of great danger, from which he had scarcely recovered. The prisoner's counsel contended that the injuries were not such as to constitute cutting and wounding in law. The judge said, in order that a wound, in contemplation of law, should have been inflicted, it was necessary that the *whole skin*, and not the mere *cuticle*, should have been separated and divided; and as the evidence did not show distinctly that there was such a wound, those counts of the indictment could not be sustained. The prisoner was found guilty of an assault.

It is also to be inferred that for the production of a wound, the continuity of the skin must be broken at the time of the infliction of the violence, and as a direct effect of it. Thus, if from a severe contusion, sloughing should take place, this would not constitute a wound, notwithstanding the very extensive destruction of the skin and soft parts, as an indirect result of the violence. So, if a bone of the leg be broken by a blow, and the skin lacerated, and a compound fracture produced by the assaulted party falling, it is doubtful whether this would be a wounding in a legal sense. Again, if an assault be committed with a heated solid, such as a red-hot poker, although the whole skin might here be destroyed, it is doubtful whether such an injury would constitute a wound in law. In short, this subject, whether we regard it in a medical or legal aspect, is in a very unsettled state, but in the mean time a legal remedy is provided by Lord Campbell's Act, 14 and 15 Vict., chap. 19, s. 4.

A case was decided in the Queen's Bench in Nov. 1847, which shows that in a civil action, our judges are not disposed to put too close a restriction upon the meaning of medical terms. The question here was, whether a *dislocation* was or was not a *wound*. An action was brought against a medical practitioner for negligence in the treatment of a dislocation of the arm, and a verdict was returned for the plaintiff. An application was made to the court of Queen's Bench for a rule to show cause why there should not be a new trial, on the ground of a misdirection of the learned Chief Baron, who tried the case. The declaration alleged that the plaintiff had employed the defendant, who was a surgeon, for the treatment and cure of certain *wounds, fractures, bruises, complaints, and disorders*—but the evidence showed that the defendant had been employed to cure the plaintiff of a *dislocated arm*. At the close of the plaintiff's case, it was submitted to the learned Chief Baron that there was no word in the declaration which was applicable to the case; but this objection was overruled. A dislocation, it was argued, was neither a wound, bruise, nor fracture; and the words, "complaint and disorder," were not at all applicable to a surgical case, but to internal complaints which required to be treated medically. Lord Denman, in delivering the judgment of the court, said, "It is rather strange that the pleader should have omitted the most appropriate word;" but we think the Chief Baron was quite right. Rule refused.

To constitute a wound—Should the breach of continuity be external, or does it apply to the mouth and fauces as well as the skin? This question arose at the Norwich Summer Assizes, 1849, in the case of a man named *Bolton*, charged with maliciously wounding a mare. He had thrust forcibly down the throat of the animal a stone, which had torn the fauces and œsophagus. It was objected that the injury was not a wounding within the statute, the parts injured being *internal*, and there being no proof of external blow or violence. The judge who tried the case was of opinion that it fell within the statute. Blood flowed from the broken skin, or membrane, lining the throat, and the stone was forced into the flesh; and it had been held that the injury need not be external to bring the case within the statute. The prisoner was convicted.

[In the United States the same rule has been pursued as in England, viz., that no injury to the person is a wound where the skin is not broken; hence a fracture of a bone without a solution of continuity of the skin is not, legally speaking, a wound. In France, three words are employed as almost synonymous—wounds, blows, or violence to the body, and hence either one includes all possible injuries that can result from external causes.—H.]

Wounds dangerous to life.—A medical witness is often asked whether a wound was or was not dangerous to life. In reference to persons charged with an attempt to murder or maim, a written medical opinion, or a deposition, may be demanded of a surgeon by a magistrate, in order to justify the detention of prisoners. The law has not defined the meaning of the words, "*dangerous to life*," or stated to what kind of wound the term *dangerous* should be applied. This is a point which is left entirely to the professional knowledge of the witness. It is not sufficient on these occasions that the witness should make a naked declaration of the wound being dangerous to life; he must, if called upon, state to the court satisfactory reasons for this opinion; and these reasons are rigorously inquired into by the counsel for the defence. As a general principle, it would not be proper to consider those wounds dangerous to life in which the danger is not *imminent*. A wound of a great blood-vessel, of any of the viscera, or a compound fracture with depression of the bones of the head, must in all instances be regarded as bodily injuries dangerous to life; because in such cases the danger is imminent. Unless timely assistance be rendered, these injuries will most probably prove fatal, and, indeed, they often destroy life in spite of the best surgical treatment. When, however, the danger is remote, as in a puncture or laceration of the hand or foot, which may be followed by tetanus, or in laceration of the scalp, which

may be followed by erysipelas, or in penetrating wounds of the orbit, which may be attended by fatal inflammation of the brain or its membranes, the case is somewhat different. Such injuries as these are not directly dangerous to life,—they are only liable to be attended with danger in certain cases; and therefore the medical opinion must be qualified. The law, on these occasions, appears to contemplate the direct, and not the future or possible occurrence of danger: if the last view were adopted, it is clear that the most trivial lacerations and punctures might be pronounced dangerous to life; since tetanus or erysipelas proving fatal, has been an occasional consequence of very slight injuries. A difference of opinion will often exist among medical witnesses as to whether a particular wound was or was not dangerous to life. Unanimity can only be expected when the judgment and experience of the witnesses are equal. The rules for forming an opinion in these cases will, perhaps, be best deduced from the results of the observations of good surgical authorities in relation to injuries of different parts of the body. These will form a subject for examination hereafter.

Wounds causing grievous bodily harm.—If the witness admit that the wound was not dangerous to life, then he may be required to state whether it was such as to have been capable of producing "*grievous bodily harm.*" This question is sometimes put, although the most usual practice is to leave it as an inference to be drawn by the jury from the professional description of the injury. These words have a vague signification; but it would perhaps be difficult to substitute for them others less open to objection. They evidently refer to a minor description of offence, and are applied commonly to those injuries which, while they are not actually dangerous to life, may be attended with considerable personal inconvenience, or be in some way detrimental to the health of the wounded party. It is always a question for a jury, whether the *intent* of the prisoner, in inflicting a wound, was or was not to produce grievous bodily harm. Sometimes the nature or the situation of the wound, as well as the kind of weapon used, will at once explain the intent: so far the medical witness may assist the Court, by giving a plain description of the injury, as well as of the consequences with which it is usually attended. It may so happen, that the wound itself is not of a very serious nature, and yet the intention of the prisoner may have been to do grievous bodily harm to the wounded party; or, as in the following case, the injury may be really serious, and yet the prisoner may not have intended to do grievous bodily harm. A man was indicted for feloniously wounding a girl, with intent to do grievous bodily harm. He kicked her in the lower part of her abdomen,—the surgeon described the injury as of the most serious character, and said that at one time he considered the life of the prosecutrix in danger. She was still suffering, and would probably feel the effects of the injury for the rest of her life. The judge, in summing up the case, told the jury that the material question for them to consider was the *intent* of the prisoner. It was not because serious injury was the result of the prisoner's act, that they were therefore to infer his intention was to do that injury; and they were to judge, from all the circumstances, whether, at the time he kicked the prosecutrix, he intended to do her grievous bodily harm, as was imputed to him by the indictment, or whether he was merely guilty of a common assault. He was found guilty of a common assault. (*Reg.* v. *Haynes*, Central Criminal Court, September, 1847.) In cases of this description, the intent with which the wound was inflicted must be made out by evidence of a non-medical kind. (See also the case of *Reg.* v. *Maslin*, Devizes Summer Assizes, 1838.)

These are the principal medico-legal questions connected with wounds when the wounded person is seen while *living*. We will suppose, however, that the wounded person is found dead, and an examination of the body is required to be made. The most difficult part of the duty of a medical jurist now commences. Among the numerous questions which here present themselves, we will first proceed to inquire whether the wound was inflicted on the body before or after death.

CHAPTER XXI.

EXAMINATION OF WOUNDS IN THE DEAD BODY—ALL THE CAVITIES SHOULD BE INSPECTED—ACQUITTALS FROM THE NEGLECT OF THIS RULE—CHARACTERS OF A WOUND INFLICTED DURING LIFE—OF A WOUND MADE AFTER DEATH—EXPERIMENTS ON AMPUTATED LIMBS—CAUTION IN MEDICAL OPINIONS—WOUNDS OR INJURIES UNATTENDED BY HEMORRHAGE—ECCHYMOSIS FROM VIOLENCE—EVIDENCE FROM ECCHYMOSIS—ECCHYMOSIS FROM NATURAL CAUSES—IN THE DEAD BODY—LIVIDITY—VIBICES—EFFECTS OF PUTREFACTION—IS ECCHYMOSIS A NECESSARY RESULT OF VIOLENCE?

Examination of wounds.—In examining a wound on a dead body, it is proper to observe its situation, extent, length, breadth, depth, and direction:—whether there be about it effused blood, either liquid or coagulated, and whether there be ecchymosis in the skin. It should also be ascertained whether the surrounding parts be swollen,—whether adhesive matter or pus be effused,—the edges of the wound gangrenous, or any foreign substances present in it. The wound may be best examined by gently introducing into it a bougie, and carrying on the dissection around this instrument, avoiding as much as possible any interference with the external appearances. The preservation of the external form will allow of a comparison being made at any future time between the edges of a wound and a weapon found on a suspected person. Of all these points notes should be taken, either on the spot or immediately afterwards. In the dissection, every muscle, vessel, nerve, or organ involved in the injury should be traced and described. This will enable a witness to answer many subordinate questions that may unexpectedly arise during the inquiry. One other point should be especially attended to. A medical practitioner has frequently contented himself by confining his dissection to the injured part, thinking that on the trial of an accused party the questions of counsel would be limited to the situation and extent of the wound only: but this is a serious mistake. If the cause of death be at all obscure, on no account should the inspection be abandoned until all the organs and cavities of the body have been closely examined: since it may be affirmed that a natural cause of death might have existed in that organ or cavity which the medical witness had neglected to examine. It rests with the practitioner to disprove the probability thus urged by counsel, but he is now destitute of facts to reason from: legal ingenuity will triumph, the witness will be discomfited, and the prisoner, of whose guilt there may be, morally speaking, but little doubt, will have the benefit of his inattention, and be acquitted by the jury.

In making an inspection of the body, the state of the *stomach* should not be overlooked. Death may have been apparently caused by violence, and yet really be due to poison. Wildberg was called upon to examine the body of a girl, who died while her father was chastising her for stealing. It was supposed by all that the girl had died from the effects of the violence. On the arms, shoulders, and back, many marks of violent treatment were found; and under some of them blood was extravasated in large quantity. The injuries, although severe, did not, however, appear sufficient to account for the sudden death. He therefore proceeded to examine the cavities, and on opening the stomach, he found it very much inflamed, and lined with a white powder, which was proved to be arsenic. It turned out that on the theft being detected, the girl had taken arsenic for fear of her father's anger: she vomited during the flogging, and died in slight convulsions. Upon this, Wildberg imputed death to the arsenic, and the man was exculpated. The cause of death may be easily assigned in such cases when the circumstances are known: but it is evident that without great care in conducting post-mortem examinations, the apparent may be sometimes mistaken for the real cause. (For some interesting cases and good practical suggestions on this sub-

ject, see Belloc, Cours. de Méd. Lég. 148.) Even when there may be no suspicion of poisoning, it will be necessary to observe the state of the stomach and its contents—*i. e.* to determine whether it contain food, the nature of the food, and the degree to which it may have undergone digestion. In the case of *Reg.* v. *Spicer* (Berks Lent Assizes, 1846,) the falsehood of one part of the prisoner's defence was made evident by the examination of the stomach. The deceased was found dead at the foot of a stair. The prisoner stated that *after* he and his wife had had their dinner, he heard a fall. The woman had died instantaneously, and the fall was heard by neighbours at or about the dinner hour. Mr. Hooper, the medical witness, found the stomach quite empty; there was no trace of food. It was therefore clear that this part of the prisoner's story was untrue, as, had the deceased died immediately after dinner, some portion of undigested food would have been found in the organ.

Characters of a wound inflicted during life.—If we find about the wound marks of gangrene, the effusion of adhesive or purulent matter, or if the edges be swollen and enlarged, and cicatrization has commenced, it is not only certain that the injury must have been inflicted before death, but that the individual must have lived some time after it was inflicted. Marks of this description will not, however, be commonly found when death has taken place within ten or twelve hours from the receipt of the injury. A wound which proves fatal within this period of time will present throughout much the same characters. Thus supposing it to have been *incised*, there will be traces of more or less hemorrhage, having chiefly an arterial character, and the blood will be coagulated where it has fallen on surrounding bodies: the edges of the wound are everted, and the cellular tissue around is deeply reddened by effused blood. Coagula are found adhering to the wound, provided it has not been interfered with. The principal characters of a wound inflicted during life are, then, the following:—1. Eversion of the edges, owing to vital elasticity of the skin. 2. Abundant hemorrhage, often of an arterial character, with general sanguineous infiltration of the surrounding parts. 3. The presence of coagula. The wound may not have involved any vessel, and there may be no appearance of hemorrhage,—still the edges will be everted, and the muscles and skin retracted. By an observation of this kind made on the body of a new-born child (Case of *Elphick*, March, 1848,) Mr. Prince was enabled to state that the child was living when it was inflicted—an opinion afterwards confirmed by the confession of the mother.

Characters of a wound made after death.—If the wound on the dead body be not made until twelve or fourteen hours have elapsed from the time of death, it cannot be easily mistaken for one produced during life. Either no blood is effused, or it is of a venous character—*i. e.*, it may have proceeded from some divided vein. The blood is commonly liquid, and does not coagulate as it falls on surrounding bodies, like that poured out of a vital wound. The edges are soft, yielding, and destitute of elasticity; they are therefore in close approximation. The cellular tissue around is either not infiltrated with blood, or only to a very partial extent. There are no coagula within the wound. In experimenting upon amputated limbs, I have found these characters possessed by a post-mortem wound, even when it had been produced not later than two or three hours after death, although they are best seen when the wound is not made until after the body has lost all its animal heat. In wounds on the dead subject, divided arteries have no marks of blood about them: in the living subject the fatal hemorrhage commonly proceeds from these vessels: hence, in a wound on the living, it will be found that the surrounding vessels are empty. The chief characters of a post-mortem wound are, therefore,—1. Absence of copious hemorrhage. 2. If there be hemorrhage, it is exclusively venous. 3. The edges of the wound are close, not everted. 4. There is no sanguineous infiltration in the cellular tissue. 5. There is an absence of coagula. But it may happen that a wound has been inflicted soon after the breath has left the body, and while it

was yet warm. The distinction between a wound then made and one made during life is not so well marked as in wounds inflicted at a later period after death. Observations of this kind on the human subject must of course be purely accidental; and there are many obstacles to the performance of experiments on the recently dead. I, therefore, selected limbs immediately after amputation; and there is no reason to suppose that the results obtained in these cases would differ very widely from those derived from experiments made on the entire body.

Wounds on the dead body.—In the first experiment, an incised wound, about three inches in length, was made in the upper part of the calf of the leg *two minutes* after its separation from the body, by which the gastrocnemii muscles, and the fascia covering the deep-seated layer of the leg, were divided. At the moment that the wound was made, the skin retracted considerably, causing a protrusion of the adipose substance beneath: the quantity of blood which escaped was small, —the cellular membrane, by its sudden protrusion forwards, seeming mechanically to prevent its exit. The wound was examined after the lapse of twenty-four hours: the edges were red, bloody, and everted; the skin was not in the least degree tumefied, but merely somewhat flaccid. On separating the edges, a small quantity of fluid blood escaped, but no coagula were seen adhering to the muscles. At the bottom of the wound, however, and in close contact with the fascia, was a small quantity of coagulated blood; but the coagula were so loose as readily to break down under the finger. In the second experiment, *ten minutes* after the separation of the member from the body, an incision of similar extent was made on the outer side of the leg, penetrating through the peronei into the flexor longus pollicis of the deep-seated layer of muscles. In this case the skin appeared to have already lost its elasticity, for the edges of the wound became but very slightly everted, and scarcely any blood escaped from it. On examining the leg twenty-four hours afterwards, the edges of the incision were pale and perfectly collapsed, presenting none of the characters of a wound inflicted during life. Still, at the bottom of the wound, and inclosed by the divided muscular fibres, there were some coagula of blood; but these were certainly fewer than in the former experiment. A portion of liquid blood had evidently escaped, owing to the leg having been moved. Other experiments were performed at a still later period after the removal of the limbs; and it was found that in proportion to the length of time suffered to elapse before the production of the wound, so were the appearances less distinctly marked: that is to say, the less likely are they to be confounded with similar injuries inflicted upon the *living* body. When the incised wound was not made until *two or three hours* after the removal of the limb, although a small quantity of liquid blood was effused, no coagula were found.

It is necessary to remember that, when an incised wound is the cause of death, the person dies either immediately, in which case there is a most abundant hemorrhage from the wounded organ or some large vessel,—or he dies after some time, in which case, as the wound continues to bleed during the time that he survives, the longer he lives the more copious will be the effusion of blood. In a wound inflicted after death, and while the body is warm, nothing of this kind is observed. Unless the weapon injure one of the large veins, the hemorrhage is always slight, so that the *quantity of blood* lost may assist us in determining whether the wound was made during life or after death. When the body has been moved, and all marks of blood effaced by washing, rules of this kind cannot serve a medical witness:—the time at which the wound was actually inflicted must then be deduced from other circumstances. In the case of *Greenacre*, who was tried in 1837 for the murder and mutilation of a female, this formed a material part of the medical evidence. The head of the deceased had been severed from the body, and the question was, whether the severance had taken place during life or after death. The prisoner alleged in his defence that it was after death; but the medical evidence went to establish that the head must have been

cut off while the woman was living, but probably after she had been rendered insensible by a blow on that part, the marks of which were plainly visible. This medical opinion was founded on two circumstances. The muscles of the neck were retracted, and the head was completely drained of its blood, showing that a most copious and abundant flow must have ensued at the time of separation; and therefore indicating that the circulation was probably going on at that time. On cutting off a head after death, a small quantity of blood may escape from the jugular veins; but this soon ceases, and the quantity lost is insufficient to affect materially the contents of the cerebral vessels. The chief medical witness, Mr. Girdwood, expressed himself with very proper caution, by stating, in answer to a question from the judge, that all the wounds in the neck must have been inflicted *during life or very shortly after death*, while the body still preserved its warmth. The circumstantial evidence tended to show that the deceased was first stunned, and that her head was cut off while she was in a state of stupor.

In any case in which the vital or post-mortem origin of a wound is doubtful, it will be proper to adopt the same cautious mode of expressing a medical opinion; since it must be remembered there are no decisive characters by which wounds of the kind referred to can be distinguished; and a medical witness is as likely to be wrong as right in selecting either hypothesis. It is a considerable step in evidence, when we are able to assert, that a particular wound, found on a dead body, must have been inflicted either during life or *immediately* after death; for it can scarcely be supposed, that in a case calling for criminal investigation, any one but a murderer would think of inflicting a wound upon a body immediately after death, which would assuredly have produced fatal effects had the same person received it while living. So soon as such an opinion can be safely expressed by a witness, circumstantial evidence will often make up for that which may be, medically speaking, a matter of uncertainty.

Wounds or injuries unattended by hemorrhage.—The copious effusion of blood has been set down as a well marked character of a severe wound received during life; but this observation applies chiefly to incised wounds,—cuts, and stabs. Lacerated and contused wounds of a very severe kind are not always accompanied by much hemorrhage, even when a large blood-vessel happens to be implicated. It is well known, that a whole member has been torn from the trunk, and that little blood has been lost; but in such cases, coagula are commonly found adhering to the separated parts,—a character which indicates either a vital or a very recent post-mortem origin. When a lacerated or contused wound involves a highly vascular part, although no large blood-vessel may be implicated, it is liable to cause death by copious hemorrhage. In a case tried at the Liverpool Winter Assizes, 1847 (*Reg.* v. *Cawley*,) the prisoner was charged with having caused the death of his wife by kicking her in the lower part of the abdomen. Copiou shemorrhage followed, and in spite of medical assistance the woman died very shortly afterwards, evidently from the exhaustion produced by the hemorrhage. It was stated in evidence that there was no external laceration, but the post-mortem examination showed that a contused wound (of the genitals) had been produced internally, and had given rise to fatal hemorrhage. There is nothing at all remarkable in such a result, considering the great vascularity of these parts in the female.

Contusions and contused wounds are commonly accompanied by a discoloration of the surrounding skin, to which the term ecchymosis is applied.

Ecchymosis from violence.—The subject of ecchymosis is of considerable importance in legal medicine, since it has often given rise to numerous difficulties and complicated questions. It consists essentially in the extravasation or effusion of blood from ruptured vessels into the surrounding cellular texture. An ecchymosis is in general superficial, affecting only the layers of the skin, and showing itself externally, either immediately or in the course of a short time, in the form of a deep blue, or livid red patch. According to Dr. Chowne, the former colour

is met with in the ecchymosis slowly produced; while that which is the immediate result of violence is red or livid red. In some instances, the ecchymosis is deep-seated,—the blood being effused among the muscles and beneath the fascia: its extent cannot then be so readily determined by the external discoloration, for this is commonly slight, and it appears only after the lapse of some hours, or even two or three days. Sometimes the ecchymosis shows itself not over the immediate seat of injury or around it, but at some distance from it. This is a matter of some importance to the medical jurist, since he might be led to suppose that the violence had been applied to the discoloured portion of skin, whereas the extravasation may have been produced by what some have called contre-coup, or counter-stroke. Dr. Chowne met with an instance where a young man received a severe bruise on the inner side of the ankle. In two days, ecchymosis appeared around the outer ankle. The term contre-coup is, however, inappropriate; since the blood will diffuse itself where it meets with the least resistance, and the layers of the skin in the part struck may become so condensed by the blow, that the blood is diffused in the cellular membrane of the adjoining parts. Mr. Syme met with a case where a compound fracture of the tibia, about one-third down, was produced by the wheel of a carriage passing over the leg of a woman. There was no ecchymosis around the seat of injury; but after some days, the skin of the knee and lower part of the thigh became ecchymosed. (Ed. Med. and Surg. Jour. October, 1836.) It is proper to mention, that ecchymosis may sometimes proceed from causes irrespective of the direct application of violence to the skin. Strong muscular exertion,—the act of vomiting, and many other conditions, may give rise to a rupture of the minute vessels, and to an effusion of blood in parts which have been stretched or compressed. I have known it to have been produced to a great extent around the knee without any blow, from the stretching of the ligamentum patellæ, in an individual who was trying to save himself from suddenly falling forwards with his knee bent under him. Such cases are commonly recognised by there being no mark of mechanical injury about the part:—the skin is smooth and unabraded.

It is of importance to know that violence inflicted on a living body may not show itself under the form of ecchymosis until *after death*. A case of this kind was communicated to me by Mr. J. Steavenson. A man received from behind several kicks on the lower part of the abdomen, which caused a rupture of the bladder, and death by peritonitis. He died in about thirty-five hours: but there was no ecchymosis in the seat of the blows, *i. e.* the pubic and lumbar regions, until after death. Dr. Hinze met with a case of suicidal hanging, in which it was observed that ecchymosis appeared in the course of the cord only after death. [See HANGING, post.] It has been remarked by Devergie that ecchymoses are often concealed on the bodies of the drowned, when first removed from water, owing to the sodden state of the skin; and they may become apparent only after the body has been exposed for some days.

A medical jurist must guard against the error of supposing that when a blow has been inflicted on a living person, it is necessary that the individual who is maltreated should survive for a certain period in order that ecchymosis should be produced. Among numerous instances proving the contrary, the case of the *Duchess of Praslin* (August, 1847) may be mentioned. This lady was assassinated by her husband, having been attacked while asleep in bed. The number of wounds on her person (thirty) showed that there had been a mortal struggle, which, however, could not have lasted more than *half an hour*. Yet, on inspection, there were the marks of numerous ecchymoses, which had resulted from the violent use of a bruising instrument. (Ann. d'Hyg. 1847, ii. 377.)

Changes of colour.—The changes which sometimes take place in the colour of an ecchymosed spot are worthy of the attention of a medical jurist, since they will serve to aid him in giving an opinion as to the probable time at which a contusion has been inflicted. After a certain period, commonly in eighteen or

twenty-four hours, the blue or livid margin of the spot is observed to become lighter; it acquires a violet tint, and before its final disappearance it passes successively through shades of a green, yellow, and lemon colour. During this time, the spot becomes much increased in extent, but the central portion of the ecchymosis is always darker than the circumference. These changes have been referred by Chaussier and others to the gradual dilution of the serous portion of the extravasated blood by the fluid of the cellular membrane, and its slow and uniform dispersion throughout the cells. The colour is finally entirely removed by the absorption of the extravasated blood. The extent and situation of the ecchymosis, the degree of violence by which it has been produced, as well as the age and state of health of the person, are so many circumstances which may influence the progress of these phenomena. Thus an ecchymosis is longer in disappearing in the old than in the young. Mr. Watson, of Edinburgh, found extravasated blood in an ecchymosis in an old person, five weeks after the receipt of the injury. Where the cellular membrane is dense, the ecchymosis, cæteris paribus, is not so rapidly formed; nor, when formed, do the above changes take place in it so speedily as where the blood is effused into a loose portion of membrane like that surrounding the eye or existing in the scrotum. In some instances an ecchymosis has been observed to disappear without undergoing these changes of colour at its margin. On examining an ecchymosed portion of skin which has suffered from a severe contusion, we find that the discoloration affects more or less the whole substance of the true skin as well as the cellular membrane beneath: it is necessary to remember this in forming our diagnosis.

Evidence from the form of an ecchymosis.—It not unfrequently happens that the ecchymosis produced by a contusion will assume a form indicative of the means by which the violence was offered. In hanging, the impression caused by the cord on the neck is sometimes ecchymosed, and indicates its course with precision;—so also in strangulation, when the fingers have been violently applied to the fore part of the neck, the indentations produced may serve to point out the manner in which life was destroyed. A case is mentioned by Starkie, which shows that the form of an ecchymosis may occasionally furnish very strong presumptive evidence against an accused party. In an attempt at murder, the prosecutor, in his own defence, struck the assassin violently in the face with the key of the house-door,—this being the only weapon near at hand. The ecchymosis which followed this contusion corresponded in the impression produced on the face to the wards of the key; and it was chiefly through this very singular and unexpected source of evidence that the assassin was afterwards identified and brought to trial. (Law of Evidence, vol. i. art. Circ. Ev.)

Contusions on the dead.—For our knowledge of the effects of *contusions* on the recently *dead* subject, we are chiefly indebted to Dr. Christison. This gentleman found that blows inflicted *two hours* after death will give rise to appearances on the skin similar to those which result from blows inflicted recently before death. The livid discoloration thus produced generally arose from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin, but sometimes also from an effusion of blood into a perceptible stratum of the true skin itself. He likewise found that dark fluid blood might even be effused into the subcutaneous cellular tissue in the seat of the discolorations, so as to blacken or redden the membranous partitions of the adipose cells; but this last effusion was never extensive. From this, then, it follows, that by trusting to external appearance only, contusions made soon after death may be easily confounded with those which have been produced by violence immediately before death.

If a contusion has been caused some time before death, there will be swelling of the part, and probably also certain changes of colour in the ecchymosed patch, in either of which cases there will commonly be no difficulty in forming a diagnosis. Although ecchymosis, or an appearance analogous to it, may be produced

after death, the changes in colour are then met with only under very peculiar circumstances, to be presently mentioned. If the blood found beneath the ecchymosed spot be in the state of coagulum, this will afford a remote presumption of its having been effused during life, although, in fact, it only proves that the effusion must have taken place before death, or very soon after it; and the experiments related, in speaking of incised wounds, show that the blood effused from a wound ten minutes after death, may be found in a coagulated state. Again, the circumstance of the blood effused under a contused wound being *liquid*, is not to be considered as a proof that the effusion did not take place during life; for sometimes, as in death from a sudden and violent shock of the nervous system, or in cases of rupture of the heart, the effused blood may not coagulate after death. Blood effused into the spinal canal during life is often fluid; and it is well known that the blood may be found coagulated in some parts of the body, while it remains uncoagulated in others. There is reason to believe that the blood coagulates more slowly in the dead body than in a vessel into which it has been drawn during life or after death. The blood may remain fluid in the dead body from four to eight, and, according to Donné, twelve hours after death.—(Cours de Microscopie, 52.) It rarely begins to coagulate until after the lapse of four hours; but if drawn from a blood-vessel and exposed to air, it would probably coagulate in a few minutes after its removal.

In general, those contusions which have been produced during life, and in which the effused blood remains liquid, may be recognised by the *extent* of the effusion. If, under the ecchymosed part, we find a large quantity of liquid blood, and the seat of the injury is so situated that the blood could not have become infiltrated into it, and at the same time there is no ruptured vein from which it might have flowed, we may confidently pronounce that the effusion must have preceded death. In a dead body, a contusion would cause but little extravasation, unless a vein of very large size were torn through. The sign which is most satisfactory as a criterion, in the opinion of Dr. Christison, is, however, the following:—In a contusion inflicted during life, the ecchymosed portion of cutis is generally dark and much discoloured by the infiltration of blood throughout its whole thickness; the skin at the same time is increased in firmness and tenacity. This is not, however, a uniform consequence of a contusion during life; for a blow may cause extensive extravasation beneath the skin without affecting the cutis in the manner stated. The state of the skin here described cannot, however, be produced by a contusion on a dead subject; although it is questionable whether it might not be produced if the contusion were inflicted a few minutes after death. As it is, the value of this sign is somewhat circumscribed,—it is not always produced on the living: it might be possibly produced on the recently dead; so that when it does not exist, we must look for other diagnostic marks; and when it does exist, we ought to satisfy ourselves that the contusion was not inflicted recently after death.

The period at which such injuries cease to resemble each other has not been fixed with any degree of precision; but, as in the case of incised wounds, it would seem that there is little danger of confounding them, when the contusion has not been inflicted on the *dead* subject until after the disappearance of animal heat, and the commencement of cadaverous rigidity! Dr. Christison found that sometimes the appearance of contusions could hardly be produced on the dead body two hours after death; at others they might be slightly caused after three hours and a quarter; but this period is very near the extreme limit. Whenever the warmth of the body and the laxity of the muscles are not considerable at the time the blow is inflicted, the appearance of vital contusions cannot be very clearly produced. It is probably, therefore, only on the trunk that, even in the most favourable state of the body,—namely, when the blood remains altogether liquid, any material mark resembling what may be termed a vital contusion, can be produced so late as two hours after death. (Ed. Med. and Surg. Jour. No. 99,

p. 247, et seq.) Notwithstanding these very satisfactory results, it will be seen, that from the moment of death until after the lapse of two hours, contusions may be followed by appearances on the dead body, almost identical with those observed on the living. The *earliest period* after death in which an experiment was tried on the human subject, was *one hour and three-quarters:* in this case the similarity was so strong, that we may infer, if the experiments had been performed within half an hour, or even one hour after dissolution, it would have been very difficult to say whether the blow producing the discoloration had been inflicted on the body before or after death. Dr. Christison's experiments lead to the conclusion that *severe* blows inflicted on a recently dead body, produce no greater degree of ecchymosis or cutaneous discoloration than *slight* blows inflicted before death. Assuming that the great extent of an ecchymosis would in all cases serve as a criterion that the violence producing it had been inflicted during life, it must be remembered that the importance of these facts, in relation to medical evidence, is not affected by the extent of the discoloration. It may be just as necessary to have a positive opinion on the origin of a *slight*, as on the origin of an *extensive* bruise. Trivial ecchymoses, as in cases of strangulation, if they can be certainly pronounced vital, may make all the difference between the acquittal or conviction of a person charged with murder. Again, slight ecchymosis on the bodies of the drowned may excite a suspicion of strangulation and subsequent immersion of the body in water. This question is quite irrespective of the *extent* of the ecchymosis,—the great point for the medical witness to consider is whether it occurred during life or after death. Cases in which a mistake might easily have arisen will be related in speaking of marks of violence in the drowned.

The practical inference, then, is, that these post-mortem discolorations are liable to be mistaken for marks of violence to the living body. An instance has been communicated to me, on respectable authority, in which, for the sake of experiment, blows with a stick were inflicted on the recently dead body of a female, while still warm. The body was afterwards accidentally seen by non-professional persons, who were not aware of the performance of these experiments, and so strong was the impression, from the appearances, that the deceased had been maltreated during life, that a judicial inquiry was actually instituted, when the circumstances were satisfactorily explained. The fact, therefore, that severe blows after death resemble slight blows during life, is, in a practical view, unimportant. It does not aid our diagnosis, nor prevent serious mistakes from occurring.

Ecchymosis from natural causes in the living.—There are certain conditions of the body in which ecchymosed marks are found on the skin, and which a witness must be careful not to confound with the ecchymosis arising from violence. First, with regard to the living body,—in very aged persons, it is not unusual to find the legs and feet covered with livid patches, sometimes of considerable uniformity of colour, at others very much mottled. These discolorations, which, after death, might be mistaken for ecchymosis from violence, arise from the languor of the capillary circulation in such subjects: the blood with difficulty finds its way through the venous capillaries, and the marks are commonly observed on the lower parts of the body, because they are far removed from the centre of circulation, and the blood has to rise contrary to the law of gravity. This is the condition which has been denominated, by Andral, asthenic hyperemia. (Andral, Anat. Pathol. t. i. p. 40.) Similar discolorations are sometimes met with on the bodies of those who have died from scurvy, typhus, and other adynamic diseases. In persons severely affected with scurvy, it is well known that the slightest pressure on any part of the skin will suffice to produce a spot resembling the ecchymosis of violence, and arising like it from a rupture of minute cutaneous vessels; but the extravasation of blood, which causes the discoloration, is commonly confined to the superficial layers of the true skin. These spots, under certain states of the system, occur spontaneously, and often cover the body to a great extent:

when small, they take the name of *petechiæ;* but when extensive, in which case they bear a very close resemblance to the ecchymosis of violence, they constitute the chief pathognomonic character of the disease termed *purpura*. To all these effusions of blood in the living body, the term *Sugillation* (from *sugillatio*, a black mark) has been applied. Some medical jurists have attempted to draw a distinction between ecchymosis and sugillation: thus it is said:—ecchymosis proceeds from external, sugillation from internal causes,—ecchymosis is confined to the marks which occur in the living body, sugillation to those which occur in the dead;—in ecchymosis the vessels are ruptured, in sugillation there is mere congestion;—again, some have considered that ecchymosis and sugillation might take place both in the living and in the dead. From this statement, it appears impossible to give a consistent definition of the meaning of either of these terms; but it is altogether unnecessary to make the attempt, for the error, after all, consists in the introduction of a superfluity of words to express a simple condition of the body, depending on different causes. Why, according to the view taken by Chaussier, an ecchymosis should not also be called a sugillation, it is difficult to say: for so far as we are bound by a comparison of the definitions above given with the usual applications of these words, the terms are equally appropriate. I would advise a medical jurist to avoid the use of the term sugillation, if by employing it he considers that he is speaking of a condition essentially different from ecchymosis. The most important point to attend to is to distinguish these ecchymoses in the living body arising from infirmity or disease, from those which have their origin from violence. In regard to the spots on the legs of old persons, the appearance of the subject, and their general extent, enveloping, as they often do, the whole circumference of the leg, must suffice to establish a correct diagnosis. In distinguishing the spots of purpura, a difficulty may sometimes exist; but here also the appearance of the subject, the general diffusion of the spots over the whole of the body, and their simultaneous existence on the mucous membrane of the fauces and alimentary canal, cannot fail to point out that they originate from some other cause than violence. In the living, these spots have been observed to undergo the same changes of colour as the true ecchymosis of violence. It has been alleged, on the authority of Zacchias, one of the early writers on medical jurisprudence, that a diagnosis is obtained in these cases after death by a dissection of the part. According to this authority, in what is termed sugillation, *i. e.* the ecchymosis of disease, the blood is stated to be fluid, while in the ecchymosis of violence it is described as being in a thick and concrete state. In the remarks already made respecting contusions, facts have been mentioned which show that such a mode of distinction is inadmissible; neither the state of the blood nor its situation will alone suffice to determine the question. Although it has been usual to describe the ecchymosis of disease as being due to a superficial extravasation on the true skin, yet certain cases recorded by pathologists prove that in purpura the discoloration may occasionally extend through the whole substance of the integuments to the adipose tissue beneath.

Ecchymosis in the dead body. Lividity.—Ecchymosis may present itself in various forms on the skin of a dead subject. The first form, when it occurs, is almost an immediate consequence of death, but it is not fully developed until the body has cooled. It is commonly called *Cadaverous lividity*. It presents itself in diffused patches of very great extent, sometimes covering the whole of the fore part of the chest and abdomen, at other times the lateral regions of the back. The upper or lower extremities, either on their internal or external surfaces, or on their whole circumference, are often thus completely ecchymosed. The colour is sometimes purple, at others livid, and often mottled in interspaces, but it is commonly well defined in its extent by the whiteness of the surrounding skin. This form of ecchymosis is almost invariably seen on the bodies of those who die suddenly or by a violent death, as well as in individuals who perish from apoplexy, or who are hanged or suffocated. When the skin is divided, the colour

is found to be confined to the upper surface of the cutis, and never to extend through it. This discoloration is ascribed to the congestion which takes place in the capillary system, at the moment of death, in subjects that are full of blood. It is rarely seen in the bodies of those who have died from profuse hemorrhage —the skin is in these cases commonly pallid. The circumstances under which it occurs, and the characters above described, distinguish it from the ecchymosis of violence. Its existence on the dead body must be regarded as a sign of the vigour and activity of the circulation at the moment of death, and generally as a mark of death having taken place suddenly. It might seem improper to call this, which has been described as a mere capillary congestion, "*ecchymosis*," this word signifying effusion; but the term *sugillation* has been so vaguely employed by different writers, that I think the former preferable to the latter, in spite of the apparent inconsistency of its application to every variety of cutaneous discoloration. (See Henke, Zeitschrift der S. A., 1844, i. 199.)

Vibices.—Sometimes, instead of seeing this cadaverous lividity diffused in large patches over the skin, it will be disposed in stripes which traverse and intersect each other in all directions, and often cover the whole of the body. These marks, which vary from a scarlet to a dark red or livid hue, have been supposed to resemble those produced on the skin in the act of scourging or flagellation. On this account they have been called by some writers *vibices*. Sometimes the body is completely covered with them,—they are often of considerable length, and pass in a very symmetrical but occasionally tortuous course; they are chiefly observed about the sides, the upper part of the shoulders, and back. In meeting with this appearance for the first time on a subject, an individual, unacquainted with its nature, might look upon it as a strong proof of violent treatment during life, especially in a case of suspected violence; but the practitioner will distinguish it readily, by the uninjured state of the cuticle and the superficial nature of the discoloration, from those marks of violence which it is considered to resemble. In general, it appears to be produced by the wrapping of a body in a sheet or other covering soon after death, and allowing it to cool while thus wrapped up: even if a subject be allowed to cool merely with the clothes covering it, these peculiar marks will often be seen. In many cases they exist only on the back, and here they are to be ascribed to the pressure produced by the irregularities or folds in the sheet on which the body has been lying. The capillaries, it is to be observed, are always congested in or near those parts of the skin which are exposed to the least pressure. A few years since I saw a well-marked case of vibices, in which the suspicion was so strong that violence had been used to the deceased, that a coroner's inquest took place. The fore part of the body was covered with the stripes, which were of a red and livid colour: they seemed to correspond exactly to the folds of a sheet drawn tightly across the chest; and it was subsequently ascertained that the body of the deceased had been treated in this way after death. The blood was superficially diffused, and the cuticle uninjured. The circumstance above mentioned at once satisfactorily explained the cause of the appearance. These vibices, like the cadaverous lividity already described, are commonly seen in plethoric subjects; they also indicate great vigour of circulation at the moment of death.

But lividity sometimes presents itself in a more deceptive form than in either of the instances just mentioned; as in the following case. A man, aged thirty-three, died suddenly from disease of the heart. Eighteen hours after death the body was examined, and the skin was then found to be covered in different parts with patches of ecchymosis, varying in size from small spots to others of several inches in diameter. These patches were evidently due to simple lividity, although they closely simulated marks of violence produced during life. On cutting into them, the layers of the cutis as well as the cellular tissue beneath were throughout reddened by a congestion of blood. There was no decided extravasation, but small rounded semi-coagulated masses oozed out from the cells

on slight pressure. There was another extraordinary, and, so far as I know, a perfectly unexampled circumstance, in which these patches of lividity resembled the ecchymosis of violence produced during life. Around many of them there was a wide border or ring of straw colour, with various shades of green, precisely similar to those witnessed in the disappearance of an ecchymosis from the living subject. By all medical jurists it has been hitherto laid down as a positive rule, that these rings of colour, when not depending on putrefaction, are peculiar to the ecchymosis of the living body, and are never seen in the ecchymosis taking place spontaneously after death. The occurrence of this case shows with what caution general rules should be framed for medico-legal practice. Had the body of this person been found lying dead exposed on a high road, and it was proved that another man had been quarrelling with him, it is easy to imagine that a very unfavourable medical opinion might have been expressed against the party accused of the violence. This kind of ecchymosis could only have been distinguished from that of violence during life, by the unruffled state of the skin, and the very slight extravasation of blood compared with the extent of the ecchymosed surface. It is worthy of note, also, that the principal seat of the ecchymosis was in those parts which were recumbent or depending. The formation of the coloured zones around some of the patches of lividity, was fully explained by the fact of the man having laboured under anasarca. The serum effused in the cells here acted upon and diluted the blood as it became extravasated; and diffused it around, much in the same way as the serous exhalation of the cellular membrane acts on the blood effused in the living body. A wax model of this remarkable appearance is preserved in the Museum of Guy's Hospital, and is well worthy of inspection.

Effects of putrefaction.—Another form of ecchymosis observed in the dead body is that which occurs some time after death. This appears to proceed from an infiltration of blood into the depending parts of the body, and to be a result of incipient putrefaction. Those engaged in post-mortem inspections are well aware that the skin of the back, especially that covering the loins and buttocks, often presents irregular discolorations resembling ecchymosis. The skin of the occiput is a well known seat of this form of ecchymosis. On cutting into the skin of any of these parts, the whole of the cutis is found to be more or less discoloured, and the adipose tissue is filled with a sanguineous serum which readily escapes. In proportion as putrefaction advances, the discoloration becomes greater, passing from a dark red to a green colour. The general characters of this species of ecchymosis are so well marked, that it cannot easily be confounded with the ecchymosis of violence. The parts of the body in which it is known to occur, as well as the state of the body, are circumstances which distinguish it from all the other forms described. This variety of ecchymosis is also termed sugillation by some medical jurists. (On the subject of Ecchymosis, see Ann. d'Hyg. 1843, ii. 388.)

Is ecchymosis a necessary result of violence?—This is a most important medico-legal question, and one which has often created great difficulty to medical witnesses. It has been repeatedly asserted in Courts of law, that no severe blow could have been inflicted on a deceased person in consequence of the absence of ecchymosis from the part struck; but we shall see that this assertion is entirely opposed to well ascertained facts. However true the general principle may be, that severe contusions are commonly followed by ecchymosis, it is open to numerous exceptions; and unless these be known to the practitioner, his evidence may mislead the Court. The presence of ecchymosis is commonly presumptive evidence of the infliction of violence: but its absence does not negative this presumption.

It was long since remarked by Portal, that the spleen had been found ruptured from blows or falls, without any ecchymosis or abrasion of the skin appearing in the region struck. This has been more recently observed in respect to ruptures

of the stomach, intestines, and urinary bladder, from violence directly applied to the abdomen. Portal supposed that the mechanical impulse was simply transferred through the supple parietes of the abdominal cavity to the viscera behind, as in the striking of a bladder filled with water. Whether this be the true explanation or not, it is quite certain that the small vessels of the skin often escape rupture from a blow, so that their contents are not extravasated. A case is reported by Henke, in which a labouring man died some hours after fighting with another; and on inspection of the body, the peritoneum was found extensively inflamed, owing to an extravasation of the contents of the jejunum, which had been ruptured to a considerable extent. There was, however, no ecchymosis or mark on the skin externally, and the medical inspectors were inclined to affirm, contrary in this case to direct evidence, that no blow could have been struck; but others were appealed to, who at once admitted that the laceration of the intestine might have been caused by a blow, even although there was no appearance of violence externally. Mr. Watson states that a girl aged nine received a smart blow upon the abdomen from a stone. She immediately complained of great pain; collapse ensued, and she died in twenty-one hours. On inspection there was no mark of injury externally; but the ileum was found ruptured, its contents extravasated, and the peritoneum extensively inflamed. (On Homicide, 187.) Dr. Williamson, of Leith, met with a case where a man received a kick on the abdomen from a horse:—he died in thirty hours from peritonitis. The ileum was found to have been torn completely across in its lower third. There was not the slightest trace of ecchymosis externally; and this fact is the more remarkable, since the blow was here struck by a somewhat angular or pointed body—the hoof of a horse. (Med. Gaz. May, 1840.)

Many cases might be adduced in support of the proposition that ecchymosis is not a necessary or constant result of a severe contusion; but those already related sufficiently establish the fact. This medico-legal question was raised on a trial before the Justiciary Court of Glasgow, in January, 1837. A woman was found dead in her house, and her husband was accused of having murdered her. There was no mark of violence externally; but on opening the abdomen, the liver was found extensively lacerated, and there was no doubt that this was the cause of death. A medical witness asserted that, as there was no appearance of injury externally, the rupture could not have been caused by a fall or a blow. He attributed the absence of marks of ecchymosis to the rupture having been occasioned by the forcible pressure of some heavy rounded smooth body on the abdomen. The prisoner was acquitted on a verdict of not proven. The liver is seldom ruptured except from violence directly applied; and it is observed that the rupture is more commonly caused by the *sudden* than by the slow application of violence. The explanation given by the witness would neither account for the rupture nor for the absence of ecchymosis; for these conditions are more commonly met with under directly opposite circumstances. At the same time, in cases where the facts are imperfectly known, a surgeon must not be too ready to assume, in the absence of ecchymosis or abrasion, that violence has been directly applied, and caused the rupture of an internal organ. The liver may have been ruptured in the above case either by a blow or a fall,—the absence of ecchymosis in the skin of the abdomen is not incompatible with either view.

CHAPTER XXII.

EVIDENCE OF THE USE OF A WEAPON—CHARACTERS OF WOUNDS CAUSED BY WEAPONS.—INCISED, PUNCTURED, LACERATED, AND CONTUSED WOUNDS—STABS AND CUTS—WHAT ARE WEAPONS?—EXAMINATION OF THE DRESS.

Evidence of the use of a weapon.—It sometimes happens on criminal investigations, that a weapon is presented to a medical witness; and he is required to say, whether a wound, found on the body of a person, was produced by it. On the certainty of a weapon having been used, it is not uncommon for prisoners, even when found guilty upon the clearest evidence, to declare that no weapon was employed by them, but that the wound had been occasioned by accidental circumstances. A witness should remember, that he is seldom in a position to swear that a particular weapon produced at a trial must have been used by the prisoner:—he is only justified in saying, that the wound was caused either by it, or by one similar to it. In reference to this subject, Schwörer relates the following case. A man was stabbed by another in the face, and a knife, with the blade entire, was brought forward as circumstantial evidence against him,—the surgeon having declared that the wound must have been caused by this knife. The wounded person recovered; but a year afterwards an abscess formed in the face, and the broken point of the real weapon was discharged from it. The wound could not therefore have been produced by the knife which was brought forward as evidence against the prisoner at the trial. (Lehre von dem Kindermorde.) Although the criminality of the act is not lessened or impugned by an occurrence of this kind, it is advisable that such mistakes should be avoided by the use of proper caution on the part of a witness. (On this question, see the case of *Renaud*, by Dr. Boys de Loury, Ann. d'Hyg. 1839, xi. 170. As to what is a weapon, see Henke, Zeitschrift der S. A. 1844, i. 67.)

Characters of wounds produced by weapons.—Let us now suppose that no weapon is discovered; and that the opinion of a witness is to be founded only on an examination of the wound. It is right for him to know that on all criminal trials, considerable importance is attached by the law to the fact of a wound having been caused by the use of a weapon; since this often implies malice, and in most cases a greater desire to injure the party assailed, than the mere employment of manual force. Some wounds at once indicate that they must have been produced by weapons. This is the case with cuts or stabs.

Incised wounds.—In incised wounds, the sharpness of the instrument may be inferred by the cleanness and regularity with which the edges are cut: in stabs, also, the form and depth of the wound will often indicate the kind of weapon employed. Stabs sometimes have the characters of incised punctures, one or both extremities of the wound being cleanly cut, according to whether the weapon was single or double-edged. Dupuytren has remarked, that such stabs, owing to the elasticity of the skin, are apparently smaller than the weapon—a point to be remembered in instituting a comparison between the size of the wound and the instrument. A lateral motion of the weapon may, however, cause a considerable enlargement of the wound. (See case, Ann. d'Hyg. 1847, i. 400.) When a stab has traversed the body, the entrance-aperture is commonly larger than the aperture of exit; and its edges, contrary to what might be supposed, are sometimes everted, owing to the rapid withdrawal of the instrument. That facts of this kind should be available as evidence, it is necessary that the body should be seen soon after the infliction of a wound, and before there has been any interference with it.

Punctured wounds.—It is important to notice whether the edges of a punctured

wound be lacerated and irregular, or incised; because it may be alleged in the defence, that the wound was produced by a fall on some substance capable of producing an injury somewhat resembling it. In a case that occurred to Mr. Watson, a deeply penetrating wound on the genital organs of the deceased, which had evidently caused the woman's death, was ascribed by the prisoners charged with the murder, to her having fallen on some broken glass; but it was proved that the edges of the wound were bounded every where by clean incisions, which rendered this defence inconsistent, if not impossible. I have known a similar defence made on two other occasions, where the cases came to trial. In one, a man struck the prosecutor, and knocked him against a window. On examination, there were three deep cuts on the face of the prosecutor, but no weapon had been seen in the hands of the prisoner. He was charged with cutting and stabbing. The surgeon deposed that the wounds appeared to have been inflicted with a knife or a razor blade, and not by broken glass. If the wounds had been made by glass, particles of that substance would probably have been found in them; but there were none. The prisoner was acquitted, the infliction of the wounds by a weapon not being considered to have been made out. In another case that occurred in August, 1841, the prosecutor was knocked down, and his throat was found severely cut; but there was no proof that a weapon had been used. In the defence it was urged that the wound had been produced by a broken pane of glass; but the surgeon described it as a clean cut, five inches in length, and one inch in depth, laying bare the carotid artery. He considered that it must have been done by a razor or knife; and that it was a cut made by one stroke of the instrument. In the case of *Reg.* v. *Ankers* (Warwick Lent Assizes, 1845,) a clean cut, as from a penknife, about two inches long, and one deep, was proved to have existed on the person of the prosecutor, who had fallen during a quarrel with the prisoner. Some broken crockery was lying near the spot, and it was alleged in the defence that a fall upon this had caused the wound. This allegation was quite inconsistent with the clean and even appearance of the wound, and the prisoner, in whose possession a penknife had been found, was convicted.

In general, wounds made by glass or crockery are characterized by their great irregularity and the unevenness of their edges. Cases of this kind show that as it is not always possible to know when this sort of defence may be raised, a medical witness should never fail to make a *minute examination* of a wound which is suspected to have been criminally inflicted. A trial for murder took place at the Worcester Summer Assizes, in 1838, in which it appeared in evidence that the deceased had died from a small punctured wound in the thorax. It was five inches and a half deep, and it had completely traversed the right ventricle of the heart, and led to death by hemorrhage. The wound was supposed to have been produced by a small skewer, which was found near the spot: but in the defence it was alleged that the deceased had fallen over a tub, and that the wound had been caused by a projecting nail. This allegation, however, was negatived by the surgeon, from the fact of its being a clean *cut* wound. Had it been produced in the manner alleged by the prisoners, the fact would have been indicated by an irregularity of margin. In the case of *Bryant* (Taunton Lent Assizes, 1849,) which involved a charge of maliciously stabbing the prosecutor, the defence was that, as many flints were lying about in the road, and the assault took place in the dark, the wound might have been inflicted accidentally during a fall. The medical witness could not say that the wounds have been positively caused by a weapon: they might have been produced by the flints. The prisoner was acquitted. A careful examination made at the time of the injury, would most probably have enabled the witness to give a positive opinion, instead of leaving the case open to doubt. A puncture made by a flint during a fall is not likely to resemble a stab with a knife. The wound would present some marks of laceration and great irregularity. As the wound was under the ear, it was by no

means probable from the situation, that it could have been thus caused accidentally.

Lacerated and contused wounds.—Lacerated wounds do not in general present more difficulty with regard to their origin than those which are incised or punctured. The means which produced the laceration are commonly well indicated by the appearance of the wound. These injuries are generally the result of accident; they are, however, frequently met with on the bodies of new-born children, in which case they may give rise to charges of infanticide. *Contused* wounds and severe contusions present much greater difficulty to a medical jurist. It is not often in his power to say whether a contused wound has resulted from the use of a weapon, from a blow of the fist, or from the deceased having accidentally fallen against some hard surface. This question is frequently put to medical witnesses, on those trials for man-slaughter which arise out of the pugilistic combats of half-drunken men. One of the combatants is generally killed, either by a blow on the head, by a fall, or by both kinds of violence combined. The skull may or may not be fractured; and the person may die of concussion, inflammation of the brain, or from extravasation of blood. The general defence is, that the deceased struck his head against some hard substance in falling on the ground; and the surgeon is asked whether the particular appearances might not be explained on the supposition of a fall. This, in general, he admits to be possible, and the prisoner is acquitted. A medical witness is rarely in a position to swear with certainty, that a contused wound of the head must have been produced by a weapon, and not by a fall. Some circumstances, however, may occasionally enable him to form an opinion on this point. If there be contused wounds on several parts of the head, with copious effusion of blood beneath the skin, the presumption is that a weapon must have been used. If the marks of violence be on the vertex, it is highly probable that they have been caused by a weapon, since this is not commonly a part which can be injured by a fall. According to the medical evidence given on this question, an indictment may or may not be sustained. A case is reported in which a prisoner was indicted for striking the deceased, and fracturing his skull with a piece of brick. The evidence showed that the prisoner struck with his fist, and that the deceased in consequence fell upon the piece of brick, which caused the fracture and led to death. The judges held that this was a fatal variation. (Law Times, Mar. 21, 1846, 501.) Technicalities of this kind will probably be set aside in future cases under the new statute, 14 and 15 Vict. c. 100.

We may be often in doubt whether, in respect to lacerated or contused wounds, a *weapon* has been used or not. Contused wounds on bony surfaces, as on the cranium, have somewhat the appearance of incised wounds, the skin being sometimes evenly separated; still, when the wound is recent, a careful examination will generally enable a witness to surmount the difficulty. If some time have elapsed before the wound is examined, there will necessarily be great caution required in forming an opinion. In some instances an accurate observation of the form of the wound, and a comparison of it with the supposed weapon, will justify a medical witness in giving a strong opinion on the point. The depth and nature of the wound may be such that no accidental fall will reasonably account for its production. A case of considerable importance in reference to this medico-legal question was tried at the late Cornish Assizes; for a report of which I must refer the reader to the Medical Gazette, xlviii. p. 729. (*Reg.* v. *Teague*, Cornwall Summer Assizes, 1851.)

Stabs and cuts.—It has already been remarked, that the law in some cases attaches great importance to the clear proof of the use of a weapon; and a medical man has therefore a serious responsibility thrown upon him when, in the absence of a weapon, he is called upon to say, from an examination of the wound, whether one has been used or not. The statute on wounding makes no reference to the means by which wounds are inflicted; but the words have been hitherto

held by the judges to imply, in all cases, the use of some *weapon* or instrument. The following are the provisions of the law. "Whosoever shall stab, cut, or wound any person, or shall, by any means whatsoever, cause to any person any bodily injury dangerous to life, with intent in any of the cases aforesaid to commit murder, shall be guilty of felony." (1 Vict. c. 85, s. 2.) The word stab has been held to import a wound from a pointed instrument; the word cut, from an instrument having an edge; and the word *wound* comprises incised, punctured, lacerated, contused, and gun-shot wounds; thus including all stabs and cuts, and rendering the separate use of these words in the statute wholly unnecessary. All medical men know that stabs and cuts are varieties of wounds; and it is difficult to understand why these terms should have been retained, and the other varieties of wounding, as "incise, puncture, lacerate, and contuse," omitted. It was formerly held that an indictment for cutting would not be supported if the medical evidence proved that the alleged cut was a stab, and *vice versâ;* and further, in an indictment for cutting and stabbing, it was not considered sufficient to prove that it was a contused or lacerated wound.

Some doubt has also arisen regarding the meaning of the term *weapon*. Thus, the teeth, the hands or feet uncovered, have been held by the majority of the judges not to be weapons; and injuries produced by them, however severe, have not been hitherto treated as wounds within the meaning of the statute. Parties have been tried on charges of biting off fingers and noses, and the medical evidence has shown that great disfigurement and mischief had been done to the prosecutor; but in these cases the degree of injury produced—the division of the cutis—was not so much regarded as the actual method by which it was accomplished. From a trial which took place at the Nottingham Assizes in 1832, it appears, however, that artificial arms and legs were not exempted under the statute. In this case alluded to, a strenuous effort was made by the prisoner's counsel to show that the wooden arm with which the assault was committed had become, by long use, part of the body of the prisoner, and that, like the natural arm, it ought not be considered a weapon in law! The objection was overruled.

Since the former edition of this work was published, a great improvement has taken place in this part of our criminal law, whereby much trouble is saved to counsel and medical witnesses. The technicalities which arose out of the necessity of strictly defining the nature of a wound, and whether it had or had not been caused by a weapon, are now in great part removed by the 14 and 15 Vict., chap. 19, sec. 4. It is herein provided that punishment shall follow the conviction of a person who has inflicted grievous bodily harm, whether with or without any weapon or instrument, or who has maliciously cut, stabbed, or wounded any person. A man has been recently committed for trial under this statute, for biting off part of the nose of another. The old objection that the teeth were not weapons, cannot here be raised in defence. The 14 and 15 Vict., chap. 100, is also adapted to meet those cases in which trivial technical objections are raised to the description of wounds in an indictment and of the circumstances under which they have been inflicted.

Examination of the dress.—The use of a weapon on these occasions may be sometimes inferred from the dress having been cut; although it is quite possible that a contused wound may be inflicted by a bludgeon through the dress, without tearing or injuring it. A wound may be indirectly produced by a weapon, and medical witnesses have been often questioned on this point. Thus the prosecutor may at the time have worn about his person some article of dress which received the blow, and this may have caused the wound. On a trial for maliciously wounding, which took place at the Reading Spring Assizes in 1837, it appeared in evidence, that the prisoner, while poaching, assaulted the game-keeper by inflicting on his head severe blows with a gun. At the time of the assault, the prosecutor wore a strong felt hat, which, it was contended in the defence, had caused the wounds that formed the subject of the charge. The medical witness

admitted that the wounds might have been produced either by the hat or gun. The prisoner was convicted; but the judge intimated a doubt whether this could be considered a "wounding by a weapon," within the statute. In another case, a blow was struck with a bludgeon at the head of the prosecutor, who wore spectacles. Wounds were produced, which, it was argued in the defence, had resulted from the glass of the spectacles. The prisoner was acquitted. Every case of this kind must be determined according to the circumstances accompanying it. One fact appears to me to be well established from the foregoing statements, namely, that a medical practitioner should always make a minute and careful examination of wounds which are likely to become the subject of criminal charges. In performing his duties as a surgeon, he is bound, so far as he consistently can, to notice their characters as a medical jurist.

CHAPTER XXIII.

WOUNDS INDICATIVE OF HOMICIDE, SUICIDE, OR ACCIDENT—EVIDENCE FROM THE SITUATION OF A WOUND—SUICIDAL WOUNDS IN UNUSUAL SITUATIONS—EVIDENCE FROM NATURE AND EXTENT—SHAPE—EVIDENCE FROM THE DIRECTION OF A WOUND—WOUNDS INFLICTED BY THE RIGHT OR LEFT HAND—ACCIDENTAL AND HOMICIDAL STABS—EVIDENCE FROM THE PRESENCE OF SEVERAL WOUNDS—THE USE OF SEVERAL WEAPONS—TWO OR MORE MORTAL WOUNDS—WOUNDS PRODUCED SIMULTANEOUSLY OR AT DIFFERENT TIMES.

Wounds indicative of homicide, suicide, or accident.—Supposing that the wound which is found on a dead body is proved to have been caused before death, it will next be proper to inquire whether it was the result of *suicide*, *homicide*, or *accident*. It might at first sight be considered, that the determination of a question of this nature was wholly out of the province of a medical jurist. In some instances it may be so, and the settlement of it is then properly left to the legal authorities; but in a very large number of cases it is so closely dependent for its elucidation on medical facts and opinions, that juries could never arrive at a satisfactory decision without medical evidence. Let us suppose, then, that a medical jurist is consulted in a doubtful case.—What are the points to which he must direct his attention? These are, with regard to the wound, its *situation*, its *nature and extent*, and its *direction*.

Evidence from the situation of a wound.—It is a general principle in which most medical jurists agree, that wounds inflicted by a suicide are usually confined to the anterior or lateral parts of the body. The throat and chest are commonly selected, where cutting instruments are employed; while the chest, especially in the region of the heart, the mouth, the orbit and the temples, are the spots generally chosen for the perpetration of suicide by fire-arms. But it is obvious, that any of these parts may be also selected by a murderer, with the especial design of simulating a suicidal attempt; therefore the mere situation of a wound does not suffice to establish the fact of suicide. Dr. Smith considers, in reference to pistol-wounds, that if the weapon has been introduced into the deceased's mouth, and there discharged, we may almost take it for granted that "it has not been done by another" (For. Med. p. 302;) but this inference has been rather too hastily drawn, because it is quite within the range of possibility, that a cool and calculating assassin may purposely resort to this method of destroying his victim, in order to conceal his crime. In suicidal wounds from fire-arms, a discoloration by powder of the fingers of the hand which discharged the weapon is sometimes observed; this has also been looked upon as a source of evidence of suicide under doubtful circumstances, but a similar objection,

although not with equal force, might be made to its admission. Some have regarded it as fully established in legal medicine, that when wounds exist at the *posterior* part of the body, it is a positive proof that they have not been self-inflicted. This situation is certainly very unusual in cases of suicide; but, as Orfila observes, it is not the situation, so much as the direction of a wound, which here furnishes evidence against the presumption of suicide. A wound, traversing the body from behind to before in a direct line, is not very likely to have resulted from a suicidal attempt; at least, it must be obvious that it would require more preparation and contrivance on the part of a self-murderer, so to arrange matters, that such a wound should be produced, than we can conceive him to possess at the moment of attempting his life. Besides, his object is to destroy himself as quickly and as surely as circumstances will permit; he is, therefore, not likely to adopt complicated and uncertain means for carrying this design into execution. Nevertheless, we must not always expect to find suicidal wounds in what a surgeon would pronounce to be, the most appropriate situation to produce instant destruction. A want of knowledge, or a want of resolution on the part of the suicide, or the accidental slipping of the hand, will often cause a wound in a part where we might least expect to find it.

Wounds which result from accident or suicide are generally in *exposed* parts of the body. An incised wound in a concealed, or not easily accessible part is presumptive of murder: because this kind of injury could have resulted only from the deliberate use of a weapon. Suicidal wounds are, however, sometimes found in the most unusual situations. In December, 1842, a surgeon destroyed himself by cutting through the brachial artery and the principal veins of his left arm with a penknife; and in another instance which occurred in 1839, a young man committed suicide by dividing the arteries of the fore arm on both sides. It is very rare that we find suicidal stabs in the abdomen or throat, but an instance occurred a few years since, where a woman destroyed herself by a stab in the lower part of the abdomen; and several similar cases are recorded by medico-legal writers. In an attempt at suicide, which fell under my own observation, a stab was inflicted by a carving-knife on the fore-part of the neck, traversing the parts from the trachea to the spinal column. In regard to situation, it has been remarked, that there is no wound which a suicide is capable of inflicting upon himself, which may not be produced by a murderer; but there are many wounds inflicted by a murderer, which, from their situation and other circumstances, a suicide would be incapable of producing on his own person. We cannot always obtain certainty in a question of this kind; the facts will often allow us to speak only with different degrees of probability. A remarkable instance of the singular situation selected for suicidal wounds, is reported in the Medical Gazette, vol. xlv. p. 439.

The situation of a wound sometimes serves to show whether it be of an *accidental* nature or not,—a point often insisted on in the defence. Accidental wounds generally exist on those parts of the body which are exposed. Some wounds, however, forbid the supposition of accident, even when exposed; as deeply incised wounds of the throat, and gun-shot wounds of the mouth and temples. (For the report of a case in which an accidental wound on the head by an axe closely simulated a homicidal wound, see Casper's Wochenschrift, May 24, 1845.)

Evidence from the nature and extent of a wound.—Generally speaking, the wound met with on the body of a suicide, where fire-arms have not been used, is incised or punctured. Contused wounds are rarely seen in cases of suicide, because in producing them there is not that certainty of speedily destroying life to which a self-murderer commonly looks. There are, of course, exceptions to this remark; as where, for instance, a man precipitates himself from any considerable height, and becomes wounded by the fall. Circumstantial evidence will however rarely fail to clear up a case of this description. Greater difficulties may exist when life is destroyed by a contused wound, voluntarily inflicted.

A case is related by a medico-legal writer in which a man first attempted to destroy himself by running with his head against a wall; and not having succeeded in this attempt, he struck himself repeatedly on the forehead with a cleaver. By this he produced such violent injury to the brain, that death soon followed. The man was seen to commit the crime by several witnesses: had this not been the case, the nature of the wound was such as to have excited suspicion that it had been inflicted by another, and that the man had been murdered.

A close attention to the *shape* of wounds made by cutting instruments will sometimes lead to the development of cases rendered doubtful from the circumstances under which the dead body of a wounded person is found. A few years since, the body of a respectable farmer was found lying on a high road in one of the midland counties. The throat was severely cut, and he had evidently died from the considerable hemorrhage which had taken place. A bloody knife was discovered at some distance from the body, and this, together with the circumstance of the pockets of the deceased having been rifled, led to a suspicion of murder. The suspicion was confirmed when the wound in the throat was examined by a surgeon. It was cut, not as is usual in suicides, by carrying the cutting instrument from before backwards, but as the throats of sheep are cut, when slaughtered by a butcher. The knife had been passed in deeply under and below the ear, and had been brought out by a semi-circular sweep in front, all the great vessels of the neck, with the œsophagus and trachea, having been divided from behind forwards. The nature of this wound rendered it at once improbable that it could have been self-inflicted; and it further served to detect the murderer, who was soon after discovered. The prisoner, who was proved to have been a butcher, was subsequently tried and executed for the crime.

It is necessary to bear in mind, that maniacs, when they commit suicide, often inflict upon themselves wounds of a very extraordinary nature,—such as would, at first view, lead to a suspicion that they had been produced by the hand of a murderer; and, therefore, the rules which are here laid down to distinguish homicidal from suicidal wounds, must be very guardedly applied to the cases of those individuals who are known to have laboured under insanity. Perhaps one of the most remarkable cases of this kind is that recorded by Mr. Tarleton. A gentleman was found lying in a state of insensibility in the kitchen of his house, with a cleaver by his side. On examining the head, upwards of thirty wounds were found over the posterior portion of the occipital bone. The wounds, many of which were superficial, had a horizontal direction from behind forwards. One, however, had removed a portion of the skull from the middle of the lambdoidal suture, so that the brain had escaped. This person, who was a lunatic, died four days afterwards, but recovered so far as to admit that he had produced the wounds on himself, of which, from other circumstances, there could have been no doubt. This was a most unusual way of committing suicide. Had the deceased been found dead on a public highway, thus wounded, it is probable that a strong suspicion of murder would have arisen. In 1850, a case occurred at Guy's Hospital, in which a person in a fit of delirium tore away the whole of the abdominal muscles from the lower and fore-part of the abdomen. Had the body of this individual been found dead with such an unusual and serious personal injury, it is not improbable that it would have been pronounced homicidal and not suicidal. In this point of view, a case which has recently occurred to Dr. W. Burke Ryan is also of great interest. The suicide here contrived to cut his throat exactly between the os hyoides and the larynx, having previously made two distinct cuts on the thyroid cartilage. The wound was of a most extensive kind, reaching backwards through the pharynx to the cervical vertebræ, one of which had been touched by the razor. The carotids and jugulars had escaped, but some of the larger branches were divided. The man survived about seven hours. (Med. Times, Jan. 17, 1852, page 73.) Cases of this kind should be borne in

mind, when we are called upon to speak to the *possibility* of certain wounds found on a dead body having been self-inflicted. (Med. Gaz. xxiv. 276.)

The *extent* of a wound, by which we are to understand the number and importance of the parts injured, must in these cases be always taken into consideration. It has been somewhat hastily laid down as a rule, that an extensive wound of the throat, involving all the vessels and soft parts of the neck to the vertebral column, could not be inflicted by a suicide. Although, in general, suicidal wounds of this part of the body do not reach far back, or involve the vessels of more than one side, yet we find occasionally that all the soft parts are completely divided to the vertebræ. These are cases in which, perhaps, with a firm hand, there is a most determined purpose of self-destruction. In a case of suicide, observed by Marc, the weapon had divided all the muscles of the neck, the larynx, and œsophagus,—had opened the jugular veins, and both carotid arteries,—and had even grazed the anterior vertebral ligament. A wound so extensive as this is certainly rarely seen in cases of suicide; but there is no ground for the assertion, that these extensive wounds in the throat are at all incompatible with self-destruction.

Incised wounds in the throat are generally set down as presumptive of suicide; but murderers sometimes wound this part for the more effectual concealment of the crime. Circumstances connected with the form and direction of the wound often, in such cases, lead to detection; for, unless the person attacked be asleep or intoxicated, resistance is offered,—evidence of which may be obtained by the presence of great irregularity in the wound, or the marks of other wounds on the deceased. In some instances, however, it is extremely difficult to say whether the wound be homicidal or suicidal,—the medical facts being equally explicable on either hypothesis. (See case by Marc, Ann. d'Hyg., 1830, ii. 408:—another by Devergie, ib. 414; and a third by M. Ollivier, Ann. d'Hyg., 1836, i. 394.)

The nature or the extent of a wound or of other injuries on the person, will sometimes allow us to distinguish, very positively, *accident from homicide*. These personal injuries may be such that they could not possibly have had a suicidal or accidental origin. In a case that occurred at Manchester, in October, 1836, it was shown by the medical evidence that seven ribs were fractured on one side of the thorax of the deceased, and five on the other. The person charged with murder alleged in defence, that he had merely struck the deceased a slight blow, and that the ribs had become broken subsequently by an accidental fall. The medical witness, however, satisfied the Court, that the fall, as described by the prisoner, was inadequate to the production of such extensive violence; and that even had the deceased fallen on *one* side, this would not account for the fracture of the ribs on the *other*. When, therefore, we find in a dead body severe injuries referred to a fall, we should search the whole of the body carefully for marks of violence. The insides of the arms or thighs might present marks of injury, which could not possibly be explained on the supposition of an accidental fall. Severe contusions on both sides of the body, or anteriorly and posteriorly, commonly indicate homicidal violence.

Evidence from the direction of a wound.—The direction of a wound has been considered by some to afford presumptive evidence sufficiently strong to guide a medical jurist in this inquiry. It has been remarked, that in most suicidal wounds which affect the throat, the direction of the cut is commonly from left to right, either transversely or passing obliquely from above downwards: in suicidal stabs and punctured wounds, the direction is commonly from right to left, and from above downwards. In left-handed persons, the direction would, of course, be precisely the reverse. Suicidal wounds are, however, subject to such variation in extent and direction, that it is scarcely possible to generalize with respect to them. Nevertheless, an attention to these minutiæ may sometimes be of real assistance to the inquirer, especially when the body has not been moved from its position. It is recommended that the instrument with which the wound has been inflicted,

should be placed in either hand of the deceased, and the extremity moved towards the wounded part, so that it may be clearly seen whether or not the direction of the wound could correspond to it in any position. It might happen that neither arm would reach the wounded part, so as to inflict a wound of the particular direction observed: this may be the case in wounds situated on the back. It is obvious that if a murderer makes an incised wound in the throat from behind, the direction will be the same as that commonly observed in cases of suicide. (See on this point the case of *Reg.* v. *Dalmas*, Cent. Crim. Court, May, 1844.) Again, if the person attacked be powerless, the wound may be deliberately made, so as to simulate a suicidal act; indeed, murderers would seldom attack the throat, but with the design of simulating an act of suicide. A homicidal stab may also take the same direction as one which is suicidal; but this would be confined to those cases where the murderer was placed behind or aside. If in front of the person whom he attacks, the direction would probably be from left to right; but in suicide, where the right hand is commonly used, it is the reverse. All oblique wounds, passing from above downwards, are common to homicide and suicide; but those which take an oblique course from below upwards, are generally indicative of homicide; it is at least extremely rare, that a suicide, unless a lunatic, thus uses a weapon. Homicidal incisions, especially in the throat, are often prolonged below and behind the skin forming the angles of the wound, deeply into the soft parts. Those which are suicidal rarely possess this character; they terminate gradually in a sharp angle, and the skin itself is the furthest point wounded,—the weapon is not carried either behind, below, or beneath it. Exceptions to these characters may exist; but in a dark and intricate subject of this nature, we have only these limited rules to guide us. The instrument with which the wound is supposed to have been inflicted should be adapted to the edges of the incision; its sharpness may be compared with the cleanness and evenness of the cut, and its length with the depth of the incision or stab. It is no uncommon occurrence for a murderer to substitute some instrument, belonging to the deceased or another person, for that which he has employed.

Wounds inflicted by the right or left hand.—Some remarks have been made about the direction of a cut or a stab, varying according to whether the right or the left hand has been used by a suicide. It is important for a medical jurist to be aware, that there are many persons who are *ambidextrous*, *i. e.* who have equal facility in the use of the right or the left hand. This may not be generally known to the friends of the deceased; and such persons are often pronounced, even by those who have associated with them, to have been right-handed. A want of attention to this point is said to have been one of the circumstances which led to a suspicion of murder in the case of *Sellis*. (Wills' Circ. Evidence, 97.) He was found dead on his bed with the throat cut,—the razor was discovered on the left side of the bed; whereas it was generally supposed and asserted that he was a right-handed man. The truth was, he was ambidextrous,—equally expert in the use of the razor with his left and right hand; and thus the apparently suspicious circumstance of the razor being found on his left side was at once explained away.

Accidental stabs.—Severe incisions on vital parts do not often happen by accident; but severe punctures and stabs affecting vital organs, have frequently an accidental origin. These stabs arise generally from falls, while the individual is in the act of running, with a pointed instrument in his hand or his pocket. There is one character which, when thus produced, they are commonly observed to possess, namely, that their direction is from below upwards. In this way, the truth of the defence may be sometimes tested, as where a prisoner alleges that the deceased threw himself, or fell upon the weapon. Homicidal stabs may be likewise directed from below upwards; but this is somewhat rare, and not probable, unless an individual be stabbed by an oblique blow, while in the recum-

bent posture. Rules of this kind may appear to be susceptible of but little practical application; yet cases occasionally present themselves, wherein a close attention to the situation and direction of wounds may materially assist a medical jurist in forming an opinion. In a case of alleged murder, which was tried in 1843 at the Central Criminal Court, the surgeon deposed that he found, on examining the body of the deceased, a stab on the left side of the chest, near the armpit, about six inches in depth. It had wounded the right lung, and had penetrated obliquely into the right auricle of the heart, passing from left to right. He contended, very properly, that, considering the situation and direction of the wound, it was very improbable that the deceased could have inflicted it upon himself. The fact that there may be some instances in which rules of this kind will not be applicable, must not deter us from endeavouring to make a cautious application of them in doubtful cases.

Evidence from the presence of several wounds.—In suicides, commonly, one wound only is seen, namely, that which has destroyed life; and the presence of several wounds on a body, or the marks of several attempts around the principal wound, have been considered to furnish presumptive evidence of murder. But it need hardly be observed that any inferences of this kind must be very cautiously drawn, since not only may a murderer destroy his victim by one wound, but a suicide may inflict many, or leave the marks of several attempts, before he succeeds in his purpose. A case is reported in which a gentleman, labouring under mania, attempted to destroy himself. Besides many wounds on the forearm, neck, and face, which disfigured him, there were twenty-two in front of his chest. One of these had traversed the heart, producing death after some hours, by causing extravasation of blood. (Lancet, July, 1839.) In incisions on the throat, from ignorance of the situation of vital parts or from tremulousness, a suicide often produces one or more incisions of greater or less extent near that which destroyed him. This is especially the case when the instrument happens to lodge in the first instance on the cartilages of the larynx. The same remark applies to suicidal stabs, when the point of the weapon, in being directed against the chest, comes in the first instance in contact with the ribs. With respect to the throat, many cases might be cited where two, three, and even six or more incisions, have been made in this part by suicides before they have destroyed themselves. A very remarkable case is related by Dr. Handyside (Ed. Med. and Surg. Jour. Jan. 1838,) in which a gentleman who had studied medicine destroyed himself by inflicting several wounds on his throat. Incisions were found on each side, just below the angle of the jaw and in the hollow behind it. They were irregular in form, and bore the character of deep stabs. The only important vessel divided was the internal jugular vein on the right side; but, nevertheless, a large quantity of blood was lost, and this, no doubt, as it is stated by Dr. Cormack, was the real cause of death. This case is in many points of view singular; for such wounds have never before, so far as I know, been found in cases of suicide. It would appear that the deceased was ambidextrous, and that the wounds on each side of the neck were inflicted by the hand of the opposite side. The following case, which occurred in London in 1839, is somewhat similar:—A lady who had been for several days in a desponding state, was found one morning dead in her bed, in a sitting posture. On examination, two very deep and extensive wounds, which had divided the principal blood-vessels, were perceived on the right side of the neck. There were two penknives on the bed, covered with blood. From the situation and other characters of the wounds, it was inferred that they must have been inflicted with the left hand; although nothing satisfactory could be ascertained on this point. The husband and son slept in the adjoining room. There was no doubt that this was a case of suicide, although it is singular that two deep wounds should have been found thus inflicted by two different weapons on the right side of the neck, in the case of a person who was not known to be left-handed.

The use of several weapons.—In general, suicides, when foiled in a first attempt, continue to use the same weapon; but sometimes, after having made a severe incision in the throat, they will shoot themselves, or adopt other methods of self-destruction. These cases can only appear complicated to those who are unacquainted with the facts relative to self-murder. Neither the presence of several wounds by the same kind of weapon, nor of different wounds by different weapons, can be considered, of themselves, to furnish any proof of the act being homicidal. One instance has been already related, in which a lunatic, in committing suicide, inflicted *thirty* wounds upon his head. In a case of murder, when many wounds are found on a dead body, it may happen that the situation or direction of some will be incompatible with the idea of a suicidal origin.

Two or more mortal wounds.—When we find several wounds on the body of a suicide, it generally happens that one only bears about it a *mortal* character, namely, that which has caused death. On this account, it has been asserted by some medical jurists, that when two mortal wounds are found upon a body, and particularly if one of them be of a stunning or stupifying tendency (*i. e.* affecting the head,) they must be considered incompatible with suicide. An inference of this kind can be applied to those cases only in which the two wounds, existing on different parts of the body, were likely to prove immediately fatal. It must, however, be borne in mind that all suicides do not *immediately* perish from wounds which are commonly termed mortal; on the contrary, they have often the power to perform acts of volition and locomotion, which might by some be deemed wholly incompatible with their condition. It is very difficult to say whether one wound is likely to destroy life so rapidly as to render it impossible for an individual to have inflicted another upon himself. There are no rules by which, in unknown cases, the instantaneous mortality of wounds can be accurately determined,—a fact which will be apparent hereafter, from a description of cases of wounds of the head, heart, and throat.

It is not possible to say, from mere discovery of marks of contusion or injury on the head, that the deceased must have necessarily laboured under insensibility or concussion, and have therefore been afterwards unable to inflict any other wound upon himself. Injuries of the head are attended with the most singular anomalies in this respect. One individual will be rendered insensible and powerless by a blow which may leave scarcely any appreciable marks, while another will be able to walk and exert himself when the skull has been fractured and depressed, and even when a portion of the brain has been lost: in short the appearances may be such as to induce many surgeons to express an opinion that death must have taken place instantaneously. It is quite right that a medical jurist should be fully prepared for the occurrence of such anomalous cases; but a strong suspicion of homicide may fairly exist, when, besides marks of great injury to the head, a severe cut or stab is found on the body. A man is not likely to cut or stab himself after having sustained such severe violence to the head; but it is quite possible that he may have the power of precipitating himself from an elevated spot, and thereby of producing great injury to the head, after having previously attempted to cut his throat or to stab himself.

Wounds produced simultaneously or at different times.—When several wounds are found on a dead body, the question is frequently asked,—*Which was first received?* If one be what is commonly called mortal, and the others not, it is probable that the latter were first inflicted. This remark applied both to cases of homicide and suicide; but it is apparent that where, in a murderous assault, a person has been attacked by several individuals at once, the wounds may have been simultaneously produced. This is, however, a question to which it is not easy to give a general answer. Each case must be decided from the special circumstances attending it; and in most instances, unless some direct evidence be afforded, a medical opinion can be little more than conjectural. I here refer to it, because it is a question almost always put in a Court of law; and a witness

should at least prepare himself for it, by a proper examination of the medical circumstances of the case.

The case of *Reg.* v. *Spicer* (Berks Lent Assizes, 1846) affords an illustration of the importance of examining wounds minutely, as well as the locality where a dead body is found. The prisoner was charged with the murder of his wife, and the evidence against him was chiefly circumstantial. The deceased was found dead at the foot of a stair, as if she had accidentally fallen. The parietal bone was fractured, and the fracture had extended to the base of the skull. The brain was lacerated, and there was great effusion of blood. The second vertebra of the neck was fractured, and the spinal marrow torn through. These injuries were quite sufficient to account for death; and had they existed alone, there might have been no reason to charge the husband with the murder. But there was a wound on each temple, partly lacerated and partly bruised, and a branch of the right temporal artery had been divided; the injury having been inflicted, apparently, with a pointed blunt instrument. There were marks of blood on the wall at the top of the staircase, and a pointed stone, covered with blood, was found near the body. It was therefore obvious, as the deceased had fallen on the vertex, that the injuries to the two temples *laterally*, could not have been accidentally produced, for there was no projecting body against which she could have fallen in her descent; and when the force of the fall had been spent on the vertex, her body could not have rolled over, so as to produce mixed punctures and lacerated wounds on both sides of the head. All the facts tended to show that a murderous assault had been made upon her at the top of the stair, and that she had been pitched headlong backwards. The injuries received previous to the fall might have stunned her, and might not have sufficed to account for death; but their nature and situation furnished strong proof that they could not have arisen from any cause operating simultaneously, and that they were neither of accidental nor suicidal origin. The prisoner was convicted and executed. (Med. Gaz. xxxvii. 610.)

If several wounds have been inflicted through the *dress*, an examination of this may sometimes suffice to show which was first received. A man, in struggling with an assailant, received three stabs with a knife—two on the left elbow, and the third in the back. The latter was at about the level of the eighth rib; —it was vertical to the chest, and had clean edges. The lower margin was obtuse—the upper acute; hence it was evident that the cutting edge of the weapon had been directed upwards. It had traversed the left lung and the heart, and had caused immediate death. It was obvious, on examination, that this mortal wound had been first received, and the stabs at the elbow inflicted subsequently. These two stabs, which were slight, had divided the cloth coat and shirt, and had only grazed the skin, so that no blood had been effused. But the edges of the cuts in the cloth coat and shirt were stained with blood; hence it was evident that they must have been produced by a weapon already rendered bloody by a previous wound. The fact was of some importance in the case, and the correctness of the medical opinion was confirmed by the evidence at the judicial inquiry. (See Ann. d'Hygiène, 1847, i. p. 461.)

CHAPTER XXIV.

EVIDENCE FROM CIRCUMSTANCES—MEDICAL QUESTIONS—VALUE OF CIRCUMSTANTIAL EVIDENCE—THE POSITION OF THE BODY—OF THE WEAPON—THE WEAPON OR OTHER ARTICLES FOUND IN THE HAND OF THE DECEASED—EVIDENCE FROM BLOOD ON WEAPONS—MARKS OF BLOOD ON THE PERSON OR IN THE APARTMENT—POSITION OF THE PERSON WHEN MORTALLY WOUNDED—EVIDENCE FROM WOUNDS ON THE DECEASED—NO BLOOD ON THE ASSAILANT—FALLACY RESPECTING MARKS OF BLOOD. ARTERIAL DISTINGUISHED FROM VENOUS BLOOD—EVIDENCE FROM THE FORM AND DIRECTION OF SPOTS OF BLOOD.

Evidence from circumstances.—In pursuing the examination of the question respecting the homicidal or suicidal origin of wounds, the attention of the reader may be called to the force of evidence which is sometimes derived from the circumstances under which the body of a person, dead from wounds, is discovered. It may be said that this is a subject wholly foreign to the duties of a medical jurist, but I cannot agree to this statement: there are very few in the profession, who, when summoned to aid justice, by their science, in the detection of crime, do not seek for circumstances by which to support the medical evidence required of them. A practitioner would certainly be wrong to base his professional opinion exclusively on circumstantial proofs: but it is scarcely possible for him to avoid drawing an inference from these, as they fall under his observation, for or against the prisoner. His evidence may be of itself weak, and insufficient to support the charge against an accused party: in such a case, if any suspicious circumstances have come to his knowledge, he may be often unconsciously induced to attach greater importance to the medical facts than he is justified in doing; in short, he may, through a feeling of prejudice, which it is not always easy to avoid, give an undue force and value to the medical evidence. But if a proper degree of caution be used in drawing inferences from the circumstantial proofs, and they are not allowed to create a prejudice in his mind against a prisoner, a practitioner is, I think, bound to observe and record them; for, being commonly the first person called to the deceased, many facts, capable of throwing an important light on the case, would remain unnoticed or unknown, but for his attention to them. The position of a dead body,—the distance at which a knife or pistol is found,—the direction of the instrument,—whether situated to the right or left of the deceased,—the marks of blood about the person, clothes, or furniture of the apartment, are all circumstances which must assist materially in developing the real nature of a case, and in giving force to a medical opinion. Many of these circumstances can fall under the notice of him only who is first called to the deceased; and, indeed, if observed by another, no advantage could be taken of them without the assistance of a medical man.

Among the questions which present themselves on these occasions are the following:—Is the position of a wounded body *that* which a suicide could have assumed? Is the distance of the fatal weapon from the body such as to render it improbable that it could have been placed there by the deceased?—In answering either of these questions, it is necessary to take into consideration the extent of the wound, and the period at which it probably proved fatal. Again, it may be inquired: Has the deceased bled in more places than one? Are the streams of blood all connected? Are there any marks of blood on his person or clothes, which he could not well have produced himself?—These are questions, the answers to which may materially affect the case of an accused party; and the practitioner, in noticing and recording the circumstances involved in them, ought therefore to exercise due caution and deliberation. "The consideration of the nature of circumstantial evidence," observes Starkie, "and of the principles on

which it is founded, merits the most profound attention. It is essential to the well being at least, if not to the very existence of civil society, that it should be understood, that the secrecy with which crimes are committed will not insure impunity to the offender. At the same time it is to be emphatically remarked, that, in no case, and upon no principle, can the policy of preventing crime and protecting society, warrant any inference which is not founded on the most full and certain conviction of the truth of the fact, independently of the nature of the offence and of all extrinsic considerations whatever. Circumstantial evidence is allowed to prevail to the conviction of an offender, not because it is necessary and politic that it should be resorted to, but because it is in its own nature capable of producing the highest degree of moral certainty in its application. Fortunately for the interests of society, crimes, especially those of great enormity and violence, can rarely be committed, without affording vestiges by which the offender may be traced and ascertained. The very measures which he adopts for his security not unfrequently turn out to be the most cogent arguments of guilt. On the other hand, it is to be recollected, that this is a species of evidence which requires the utmost degree of caution and vigilance in its application; and, in acting upon it, the just and humane rule, impressed by Lord Hale, cannot be too often repeated:—"tutius semper est errare in acquietando quam in puniendo, ex parte misericordiæ quam ex parte justitiæ." (Vol. i. p. 480.) Evidence is *direct* when a fact is proved by witnesses, and *circumstantial* when the fact is at once proved by circumstances. More commonly the evidence is *presumptive*, i. e. founded on an inference from circumstances.

There are many cases on record in which an observance of slight and unexpected circumstances by medical men has led to the detection of offenders. In the Life of Sir Astley Cooper, it is mentioned, that when called to see *Mr. Blight*, of Deptford, who had been mortally wounded by a pistol-shot in the year 1806, he inferred, from an examination of the localities, that the shot must have been fired by a *left-handed* man. The only left-handed man near the premises at the time was a Mr. Patch, a particular friend of the deceased's, who was not in the least suspected. This man was afterwards tried and convicted of the crime:—and he made a full confession of his guilt before execution. The rules for investigating a case of poisoning (see ante, p. 53) may be equally observed in many cases of death from violence. Among the circumstances to which a medical witness should specially direct his attention on these occasions are the following:—

The position of the body.—The body may be found in a position which the deceased could not have assumed on the supposition of the wound or injury having been accidental or suicidal. The position of a dead wounded body is often only compatible with homicidal interference, either at the time of death, or immediately afterwards. In order to determine the probable time of death, we should always notice whether there be any warmth about the body,—whether it be rigid, or in a state of decomposition, and to what degree this may have advanced. In the case of a female who was found dead in her apartment with her throat cut, in November, 1847, it was ascertained that when first discovered, the body was so warm as to render it highly probable that the crime must have been committed within an hour. This observation tended to prove the innocence of a party who was suspected of the murder, because it was known that he had been absent from the house for at least five hours.

The position of the weapon.—If a person has died from an accidental or self-inflicted wound, likely to cause death either immediately or within a few minutes, the weapon is commonly found either near the body or within a short distance. If found near, it is proper to notice on which side of the body it is lying; if at a short distance, we must consider whether it might not have fallen to the spot, or been thrown or placed there by the deceased. If there has been any interference with the body, all evidence from the relative position of it and the weapon

will be inadmissible. In a case which was referred to me some time since, a woman had evidently died from a severe incision on the throat, which was homicidally inflicted; the weapon, a razor, was found under the left shoulder, a most unusual situation, but which, it appears, it had taken owing to the body having been turned over before it was seen by the surgeon who was first called. We must remember that it is quite compatible with suicide that a weapon may be found at some distance, or in a concealed situation; but it is much more frequently either grasped in the hand, or lying by the side of the deceased.

In one instance, it is stated the deceased was discovered in bed with his throat cut, and the razor lying *closed* or shut by his side. It appears very improbable that any person committing suicide, after dividing one or both carotids and the jugular veins, should have power to close or shut the razor: and there is fair ground to suspect interference when a razor is thus found closed. There is, however, one circumstance in relation to a weapon strongly confirmatory of *suicide*. If the instrument be found still firmly grasped in the hand of the deceased, no better circumstantial evidence of suicide can, perhaps, be offered. It is so common to find knives, razors, and pistols grasped in the hands of suicides, that it is quite unnecessary to produce cases illustrative of this statement. The grasping of a weapon appears to be owing to muscular spasm persisting after death, and manifesting itself under the form of what has been called cadaverous spasm—a condition quite distinct from rigidity, although often running into it. It does not seem possible that any murderer could imitate this state, since the relaxed hands of a dead person cannot be made to grasp or retain a weapon, like the hand which has firmly held it by powerful muscular contraction at the last moment of life. In this respect the case of *Reg.* v. *Saville*, Nottingham Summer Assizes, 1844, is of great interest to the medical jurist. A woman was found dead with her throat cut, and there was a razor *loose* in her hand. There was no blood upon the hand which held the razor, and this, together with the fact of its being quite loose, rendered it certain that it must have been placed there by the prisoner after having cut his wife's throat. The deceased may be found with some other article grasped in the hand. (See case, Ann. d'Hyg. 1829, i. 464.) It may be her own or the prisoner's hair torn off in the struggle for life; and on this point a question of identity may be easily raised. (*Reg.* v. *Ellison*, Bodmin Summer Assizes, 1845.) In a case which occurred to Dr. Marc, a woman was found assassinated in her house, and when the body was discovered, a small snuff-box was still held firmly in one hand. This proved that the murder must have taken place very suddenly, and without any resistance on the part of the deceased. (Ann. d'Hyg. 1829, i. 465.)

If the weapon cannot be discovered, or if it be found concealed in a distant place, this is strongly presumptive of homicide, provided the wound be of such a nature as to prove speedily fatal. In the case of *Lord William Russell*, no weapon could be discovered; and although the wound in the throat bore some of the characters of a suicidal incision, this fact alone was sufficient to show that it must have been the act of a murderer. With respect to the weapon being found at a distance from the body, other circumstances should be taken into consideration before any opinion is expressed. We may observe whether the weapon, if it be a sharp cutting instrument like a razor, has been recently notched; for this might show that a degree of force or violence has been used, not easily reconcileable with the suicidal use of the instrument. The well known case of the *Earl of Essex*, who was found dead in the Tower in July, 1683, gave rise to a doubt on this point. The deceased was discovered with his throat cut, and a razor lying near him. This razor was found to be much notched on the edge, while the throat was smoothly and evenly cut from one side to the other, and to the vertebral column. Some considered this to have been an act of suicide, others of murder. Those medical witnesses who supported the view of suicide were asked to explain how it was that such an even wound could have been produced by a

notched razor. They attempted to account for this by asserting that the deceased had probably drawn the razor backwards and forwards across the neck-bone; forgetting that before this could have been done by the deceased, all the great vessels of the neck must have been divided.

Blood on weapons.—It does not always happen that the weapon with which a wound has been produced is covered with blood. It has been remarked, that in the case of stabs, the knife is frequently without any stains of blood upon it; or there is only a slight film, which, on drying, gives to the surface a yellowish-brown colour. The explanation of this appears to be, that the weapon, in being withdrawn, is sometimes cleanly wiped against the edges of the wound in the integuments.

When a weapon is bloody, particular attention should be given to the manner in which the blood is diffused over it. In cases of imputed wounds, or in the attempted concealment of murder, it is not unusual for the criminal to besmear with blood a knife or other weapon which has probably not been used. A case of this kind occurred to the late Dr. Marc. A young man alleged that he had received a cut on the forehead by a blow from a cutlass, which he produced. It was remarked that the weapon was smeared with blood on both surfaces; but the layers were thicker towards the handle than at the point. The wound on the forehead was a clean incision; and a cap which the complainant wore had been cut through. It was obvious, therefore, that the blood on the weapon could not have proceeded from this cut; for it would have been wiped, or only left in thin striæ, and more towards the point than the handle, by the act of drawing it through the clothes in producing the wound. There was no doubt that the blood had been intentionally applied to the blade. (Ann. d'Hyg. 1829, p. 263.)

Hair on Weapons.—In some instances, no blood may exist on the weapon, but a few hairs may be found adhering to it if the weapon be of a bruising kind. The main question will be, in such a case, whether the hair is that of a human being or of an animal. See in reference to this question the case of The *Queen* v. *Teague*, Cornwall Summer Assizes, 1851, (Med. Gaz. vol. xlviii. p. 729.)

Foreign substances in wounds.—In gun-shot wounds, the examination of wadding or paper found in the wound or near the deceased, has in more than one instance led to the identity of the person who had committed the crime. His hand-writing was traced on the paper used as wadding, or it has been found to have been part of a printed page, of which the remainder has been discovered in his possession. Foreign substances may be sometimes discovered in contused or lacerated wounds; and these may throw an important light on the circumstances under which the crime was perpetrated. In the case of The *Queen* v. *Hazell* (Taunton Lent Assizes, 1848,) the body of the deceased was found in a well. When examined, there were on the head several severe wounds quite sufficient to account for death. There was much blood on the clothes and face, and in the blood were sticking a quantity of hay-seeds, which led the medical witness to consider that the wounds must have been inflicted in a stable or in some place where there was hay. On examining a neighbouring stable, the spot where the murder was committed was rendered evident by the discovery of marks of blood.

Marks of blood.—It is proper to notice all marks of blood on the person or in the apartment, and to observe where the greatest quantity of blood has been effused: this is generally found in the spot where the deceased has died. The deceased may have bled in more places than one; if so, it becomes important to notice whether there be any communications in blood between these different places. Blood on distant clothes or furniture will show whether the deceased has moved about, and whether he has struggled much after receiving the wound. Acts of locomotion in a wounded person who has died from hemorrhage, are generally indicated by tracks of blood. We must observe likewise, whether, if the wound be in the throat, blood has flowed down in front of the clothes or

person; for this will sometimes show whether the wound was inflicted when the individual was standing, sitting, or lying down. If the throat be cut while a person is lying down, it is obvious that the blood will be found chiefly on either side of the neck, and not extending down the front of the body. Few suicides cut the throat while in the recumbent posture, and the course which the blood has taken may, therefore, be sometimes rendered subservient to the distinction of a homicidal from a suicidal wound. The position in which the body was, when the wound was inflicted, is a frequent question on inquests and criminal trials. In the case of *Lord William Russell*, the throat had evidently been cut while the deceased was lying in bed; the blood was effused on each side of the neck only. There was also found a wound on the thumb of the right hand of the deceased, which must have been inflicted at the time the hand was put up to defend the throat. Recent wounds on the back of one or both hands, when found in persons who have died from wounds in the throat, are, cæteris paribus, strongly presumptive of homicide. There may, however, be no marks of wounds on the back of the hands, if the individual was attacked unexpectedly—if he was intoxicated or rendered powerless, or several had combined to attack him, while he was pinioned and held by an accomplice.

If the deceased has been wounded with his clothes on, we should notice whether any part of his dress has or has not been cut or injured over the situation of the wound. When, together with the wound in the throat, we find the cravat and the shirt, or part of the dress, cut through, this is, all other circumstances being equal, presumptive of homicide; for it is not usual that a suicide, unless labouring under confirmed insanity, would allow any mechanical obstacles of this kind to remain in the way of a weapon. In one case of a homicidal wound in the throat, inflicted in the recumbent posture, the cravat of the deceased had been lifted up, and afterwards allowed to drop over the wound in order to conceal it.

Marks of blood on the *person* of the deceased require special observation. Very often the impression of a hand, or of some of the fingers, will be found on the skin in a situation where it would have been improbable or impossible for the deceased to have produced it, even supposing that one or both of his hands were covered with blood. In one case of murder there was found the bloody impression of a left hand upon the *left hand* of the deceased, in such a situation that it was quite impossible the deceased himself could have made the mark! In other cases it may be important to state whether the inside or outside of the hand, or whether one or both hands, be marked with blood. Marks of blood on the *dress* of the wounded person may often furnish important circumstantial evidence. If there be several stabs or cuts on the body involving the dress, it should be observed whether the edge of one or more of them be stained with blood, as if from the wiping of a weapon, and whether the stain be on the outside or inside of the article of dress. In simulated personal injuries, the stain of blood may be, through inadvertence, applied to the outside of the dress—a fact which might, in some instances, lead to the detection of the imposture. (See case by Dr. Bayard, Ann. d'Hyg. 1847, ii. 219.) In judging from marks of blood in the *apartment*, we must take care that we are not unconsciously misled by the accidental diffusion of this liquid by persons going in and out. The following case, which will show the necessity of extreme caution, occurred in France. A young man was found dead in the bed-chamber with three wounds on the front of his neck. The physician who was first called to see the deceased had, unknowingly, stamped in the blood with which the floor was covered, and had then walked into an adjoining room, passing and repassing several times; he had thus left a number of bloody foot-prints on the floor. No notice of this was taken at the time; but on the following day, when the examination was resumed, the circumstance of the foot-prints was particularly attended to, and excited a suspicion that the young man had been murdered. The suspected

person was arrested, and would have undergone a trial on the charge of murder, had not M. Marc been called in to examine all the particulars of the case. A similar circumstance occurred in the case of *Eliza Grimwood*, who was murdered at Lambeth in June, 1888.

Arterial distinguished from venous blood.—It is not possible to distinguish *arterial* from *venous* blood by any physical or chemical characters, when it has been for some days effused, and has fallen upon articles of dress or furniture; but this, in medico-legal practice, is not often a subject of much importance, since there are few cases of severe wounds, either in the throat or other parts of the body, in which the two kinds of blood do not escape simultaneously. The most striking and apparent difference between them, when recently effused, is the *colour;* the arterial being of a bright scarlet, while the venous is of a dark red hue; but it is well known that the latter, when exposed to air for a short time, acquires a florid red or arterial colour; and the two kinds of blood, when dried, cannot be distinguished chemically by any known criterion. If the coat or other stuff, covered with blood, were of a dark colour, the liquid would be absorbed, and lose its physical characters. Arterial blood contains more fibrin than venous, and coagulates more firmly. Even the microscope shows no appreciable difference in the blood-corpuscles; and chemistry does not enable us to apply any test so as to make a satisfactory distinction between them. In this deficiency of microscopical and chemical evidence, an attempt has been made to establish a distinction by noticing the physical appearances of the blood-stains. Thus, it is alleged, the arterial blood will be indicated by its being *sprinkled* over surfaces upon which it has fallen, while the venous blood is always poured out in a full stream. In most wounds which prove fatal by hemorrhage, the blood is poured out simultaneously from arteries and veins. The sprinkled appearance of the blood, when it exists, will, cæteris paribus, create a very strong presumption that it was poured out from a *living* body; for after the heart has ceased to act, the arteries lose the power of throwing out the blood in jets. This mode of distinguishing arterial from venous blood was adduced as evidence in the case of *Sellis*, who destroyed himself after having attempted to assassinate the Duke of Cumberland. There was the appearance of sprinkled blood on the coat-sleeve of Sellis, and the temporal artery of the Duke had been wounded in the struggle. Sir Everard Home thence inferred that Sellis had attacked the Duke, and wounded the artery, which had led to the sprinkling of the sleeve. (Will's Circ. Ev. 98.) This method of distinguishing the two kinds of blood, therefore, may be occasionally available for practical purposes; but it must be remembered that accident may lead to the sprinkling of blood from a small vein which has been wounded, while blood may be poured out in considerable quantity from an artery, especially if large; and if it fall on one spot at a short distance, it may produce a soaked appearance. The sprinkling may be expected only when the wounded artery is small, and the blood is effused at a distance. This is a fact which a medical jurist should not overlook, although, for the reasons stated, too great a reliance must not be placed on it. The spots of blood, if thrown out from a living blood-vessel, very speedily consolidate; and the fibrin, with the greater portion of the colouring matter, is found of a deep red colour at the lower part of the spot, the upper portion being of a pale red. The lower and thicker part has commonly a shining lustre, as if gummed, when the spot is recent, and when it has been effused upon a non-absorbent surface. This glazed appearance is probably given by the evaporation of the aqueous, and the rapid desiccation of the albuminous portions. When the blood falls upon porous articles of clothing, as linen, or cotton, it is absorbed, and produces a dull stain. In dark-coloured articles of dress, it is difficult by day-light to perceive these stains. The part appears stiffened, and there is a dull red brown colour, which is more perceptible when seen by the reflection of the light of a candle. Stains of tobacco, or of the juices of certain vegetables, may present somewhat the

appearance of those of blood. The distinction between them will, however, be rendered immediately apparent by the application of the microscope and of the chemical processes to be hereafter mentioned. (See BLOOD-STAINS.)

In trusting to the coagulation of the blood as evidence of its escape from a *living* vessel, it must be remembered, that there are certain diseases, as scurvy and typhus, in which, owing to morbid causes, the blood does not readily coagulate; while, again, some hours elapse before it coagulates in the healthy body after death. Hence blood which has escaped from a recently dead body, although it would not be found diffused as if by spirting, might, in so far as coagulation is concerned, assume the appearance of having been effused from a living body. On this fact, Donné has founded a process for determining whether a person be really dead. (Cours de Microscopie, 54.)

When spots of blood are found upon articles of dress or furniture, their *form* and *direction* may sometimes serve to give us an indication of the position of the wounded person with respect to them. Thus, when the form of a spot is oval and elongated, the presumption is that the person was placed obliquely with respect to the stained furniture, during the hemorrhage. (Ann. d'Hyg. 1840, 397.) The impetus with which the blood is thrown out will be in some measure indicated by the degree of obliquity and length of the spot. This is in general wide and rounded at the upper part, but narrow and pointed below. The case of *Spicer* (ante, page 196,) furnishes some interesting suggestions on the importance of the evidence occasionally derived from examination of the form and direction taken by spots of blood. At the top of the stair, and at the height of four or five feet above the level, several spots of blood were observed upon the brick-wall. These were rendered very evident by the wall having been whitewashed. The spots took an oblique direction from above downwards, were of a pale red colour at the upper part, but dark red below, terminating in a point consisting of the fibrin and the greater part of the red colouring matter. Their form and regularity proved that they had proceeded from a small artery, and that the wounded individual could not have been very distant from the wall, while their shining lustre rendered it probable that they were of recent origin, and their well defined termination in a firm coagulum, showed that they had proceeded from a living blood-vessel. The deceased had died from fracture of the skull and vertebral column by a fall from the top-stair; one branch of the right temporal artery was found divided, and this wound could not have been produced by the fall. It was therefore evident that a murderous assault had been made upon her at the top of the stair: this had led to the spirting of the arterial blood on the brick. The height at which the spots existed, and their appearance, proved that the jet of blood had been from above downwards; thereby rendering it probable that the deceased was standing up, or that her head was raised at the time the wound was inflicted. Further, as the brick with the spots was on the left hand in the descent, and the wounded artery was on the right side, it is probable that the deceased was face to face with her assailant in the act of ascending the stairs, and that she was killed by being precipitated backwards to the bottom. The position in which the body was found in the cellar corroborated this view. (See Med. Gaz. xxxvii. 612.)

Inspection.—In examining a dead body, it is proper that attention should be paid to the state of the mouth and throat. Assassins who make their attack during sleep, sometimes endeavour to close the mouth, or to compress the throat, so as to prevent an alarm from being given. In the case of the *Duchess of Praslin*, there were the marks of finger-nails around the mouth. In another instance ecchymosed impressions, as if produced by a hand, were found upon the throat of the deceased. The hands of the deceased should always be examined; many cuts, excoriations, or incisions, found upon them, especially if on the dorsal surface, will indicate that there has been a mortal struggle with the assailant. In the inspection, the examination of the *stomach* should not be omitted. The

presence or absence of food, mucus, or blood, may furnish evidence of considerable importance in the elucidation of the case. Thus, in the stomach of the *Duchess of Praslin*, a quantity of bloody froth was discovered. This rendered it certain that she had lived sufficiently long to swallow a quantity of saliva mixed with blood, and that probably she had made some attempts to give an alarm. The fact that several days have elapsed since death, will not prevent the discovery of food in the stomach, provided it has been taken within one or two hours before death; since the digestion of food does not appear to go on to any perceptible extent after death. I have thus discovered food in the stomach twenty-eight days after interment. This question connected with the digested or undigested state of the food found in the stomach, very frequently arises on criminal trials.

CHAPTER XXV.

DISTINCTION OF SUICIDAL FROM ACCIDENTAL WOUNDS—IMPORTANT IN CASES OF LIFE-INSURANCE—WOUNDS ON THE THROAT—FACTS INDICATIVE OF SUICIDE, HOMICIDE, OR ACCIDENT—IMPUTED OR SELF-INFLICTED WOUNDS—MOTIVES FOR THEIR PRODUCTION—CHARACTERS OF IMPUTED WOUNDS—RULES FOR DETECTING FALSE CHARGES OF MURDER.

Suicidal wounds.—It is not often that any difficulty is experienced in distinguishing a *suicidal* from an *accidental* wound. When the wound has really been suicidally inflicted, there are generally to be found about it very clear indications of design; and the whole of the circumstances are seldom reconcileable with the supposition of accident. But if the position of the deceased with respect to surrounding objects have been disturbed, if the weapon has been removed, and the body transported to a distance, then it will not always be easy to distinguish a wound accidentally received, from one inflicted by a suicide or a murderer. The evidence of those who find the body can alone clear up the case; and the medical witness may be required to state how far this evidence is consistent with the situation, extent, and direction of the wound by which the deceased has fallen. It is unnecessary to dwell further on this subject, since the observations made in the preceding pages will suggest to the practitioner the course which he has to pursue. Circumstantial evidence is commonly sufficient to show whether a wound has been accidentally received or not; but as an accidental wound may sometimes resemble one of homicidal or suicidal origin, so it follows that it is not always possible for a medical jurist to decide the question peremptorily from a mere inspection of the wound. Homicide is only liable to be confounded with accident in relation to *contusions* and *contused* wounds. In cuts and stabs, the evidence of design will be in general too apparent to allow of any doubt being entertained respecting the real origin of the injury. It would not be difficult to produce many instances where murderers, in their defence, have alleged that the wounds observed in the bodies of their victims were of accidental origin, and the allegations have been clearly refuted by medical evidence. A witness must be prepared, therefore, in all cases where death has taken place in secrecy, and the nature of the wound is such as to render its origin doubtful, to be closely examined by counsel for a prisoner charged with felonious homicide, as to whether the wound might not have been accidental. Our law requires that it should be rendered evident to a jury, before such a charge can be sustained, that the fatal wound could not have been accidental or suicidal. Hence this preliminary question is deserving of serious attention from a medical jurist.

The death of a party from wounds has hitherto been considered as a subject connected with a criminal charge; but an investigation of the circumstances under

which death ensues, is occasionally rendered necessary when the deceased has effected an insurance upon his life. A policy of life-insurance is in some cases rendered void by the act of self-destruction; and therefore an individual bent on suicide might, for the sake of his family, take precautions to conceal the manner in which he intended to destroy himself. His body might be found wounded in a way which would render it uncertain whether he had been wounded accidentally, whether he had been murdered, or whether he had fallen by his own hand. In a disputed case, it is incumbent on the office to prove the act of suicide (*felo de se,*) while the relatives of the deceased would attempt to show the contrary. Such litigation must, of course, call forth a most deep and searching investigation into all the circumstances connected with the death of an insured party, and the whole case would, in some instances at least, rest almost exclusively on medical evidence. (Med. Gaz. xxxvi. 826.) Numerous cases have of late years occurred in England, which will illustrate the importance of attending to the precise characters of wounds, and the circumstances under which the body of a wounded person is found. The following may serve as an illustration:—

Wounds of the throat. Suicide or homicide?—In the year 1837, the late Mr. Dodd, of Chichester, consulted me on the following case:—He was called to examine the body of a woman, who was found dead with her throat cut. The deceased, when seen by him, was lying on her back, and the razor with which the wound was inflicted was found under the left shoulder. On inquiry, it was ascertained that when first seen, she was lying on her face, and the body had been turned round on the back. Blood had evidently run down the fore-part of her person, rendering it probable that she had been wounded while in the erect position. The incision in the throat was deep, and extended obliquely from the right side of the chin to within about an inch of the left collar-bone. It had divided the wind-pipe, the gullet, all the muscles of that side of the fore-part of the neck,—the carotid artery, jugular vein, and the muscles on the fore-part of the spine, penetrating even into the bodies of the cervical vertebræ. The incision was double,—one superficial, close under the chin, and the other, the deeper one, appeared to be continued from this. The deepest part of the right end of the incision was nearly three inches in a direct line behind the right angle of the wound, so that it extended at that part behind and beneath the sound skin. The cut was four and a half inches long, and two and a half deep. The main question was, whether this could have been a suicidal wound, inflicted by a razor, the only weapon found near the body. Considering its characters, Mr. Dodd inferred that it must have been inflicted by another person, and not by the deceased upon herself. The deceased was right-handed, which would have added to the difficulty of supposing the wound to have been suicidal. The inference drawn was precisely that which the medical circumstances appear to me to justify.

Imputed or self-inflicted wounds.—The question whether a wound was or was not self-inflicted, may refer to the *living* as well as to the dead. Thus a man may produce wounds upon himself for the purpose of simulating a homicidal assault, which, for various motives, he may allege to have been committed upon him. With the motives for the self-infliction of wounds, a medical jurist is not concerned,—it is of the fact only that he can take cognizance. From the cases that have yet occurred, it would appear that the object has been to extort money, to conceal murder, robbery, or some other crime, and to turn away suspicion from the wounded party. One of the most remarkable cases of this kind which have occurred in England, was that of *Bolam*, who was tried for the murder of a man named Millie at the Newcastle Autumn Assizes, 1839. It is impossible to enter into all the particulars of this singular trial; but it may suffice to state, that the prisoner *Bolam* was found lying in an apartment, which had been fired by himself or some incendiary, and near him was the body of the deceased, who had evidently been killed by violence,—the skull having been extensively fractured by a poker lying near. The prisoner, when found, was either insensible

or pretended to be so. He stated that he had been suddenly attacked by a man, and knocked down by a blow on the right temple. After attempting to escape, he was again knocked down. He then felt a knife at his throat, but admitted that he did not put up his hands to protect it. His hands were not cut. He said he remembered receiving some blows on his body, but he became insensible, and recollected nothing more. On examining his throat, there was a wound an inch and a half in length on the left side of the neck, a quarter of an inch below the jaw. It had penetrated merely through the true skin, and was of inconsiderable extent. A small quantity of blood, which had flowed down on the inside of his cravat, had escaped from this. There were many cuts on his coat at the back and sides, through his waistcoat, shirt, and flannel shirt; but there were no corresponding cuts or stabs, nor, indeed, any mark of injury upon the skin. The question was, whether these wounds had been inflicted by the unknown person who was alleged to have fired the premises and murdered the deceased, or whether the prisoner had inflicted them on himself, in order to divert attention and conceal the crime which he was accused of having committed. No motive for the imputed crime was discovered, and he had borne a very good character; but nevertheless, the medical facts relative to the probable self-infliction of the wounds were so strong, that he was convicted of manslaughter. There can hardly be a medical doubt that the prisoner produced the wounds upon himself, in order to remove any suspicion that he had caused the death of the deceased. They were superficial, involved no important organs, and bore the characters which those wounds only would have, that had not been produced with a suicidal intention.

Soon after Bolam's case, one somewhat similar occurred in this metropolis. The steward of a club-house was found one morning in bed wounded, and the cash-box of the club was missing. Circumstances led the police to suspect that no one could have broken into the house; but the man himself was considered so trustworthy, that no suspicion was entertained of his having been concerned in the robbery. The surgeon who examined him found the wounds on his person of a very trivial character, and there was but little doubt, from what subsequently transpired, that he had produced them on himself for the purpose of averting suspicion.

It is not always easy to trace the motive for the production of these injuries; and when a reasonable motive is not immediately discovered, persons are very apt to be misled and to credit the story. Individuals who have been convicted of thus imputing violence to others have frequently borne a respectable character until the occurrence, and this has contributed to disarm suspicion. When a person intending to commit suicide fails in the attempt, he has sometimes, under a sense of shame, attributed the infliction of a wound in his throat to another; but facts of this kind may be without difficulty cleared up by circumstantial evidence. Imputed wounds, if we except the case of an attempt at suicide, where the injury is commonly severe, are generally of a *superficial* character,—consisting of cuts or incisions not extending below the cutis:—deep stabs are seldom resorted to where the purpose is not suicide, but merely to conceal other crimes. Further, these wounds are in *front* of the person, and may be on the right or left side, according to whether the person be right or left-handed. They have also been generally *numerous*, and scattered wide apart: sometimes they have had a complete parallelism, unlike those which must have been inflicted by an adversary during a mortal conflict with a weapon. The *hands* are seldom wounded, although in the resistance to real homicidal attempts these parts commonly suffer most severely. The injuries are not usually situated over those parts of the body in which wounds are by common repute considered *mortal*, and there is in general an entire want of correspondence between the situation of the wounds on the person, and the cuts or other marks on the *dress*. This is an important fact, which requires the attention of the practitioner. In an interesting case which occurred

to Marc, a young man alleged that he had received a sword-cut in the forehead from some assassins who had escaped. He was allowed to relate the whole of the particulars, and they formed a very romantic and improbable story. He stated that he wore at the time a handkerchief round his head, a cotton cap, and a common cap with an elastic front, which he alleged had been cut through. There was a longitudinal wound, quite superficial, and about an inch long, at the upper and right part of the frontal bone, passing downwards from *left to right*. The cut in the felt of the cap, which was very soft, passed obliquely from *right to left*, and was about three inches in length. The cut was not so clean or regular as if it had been produced by a sword: there was very little blood upon the cap, and only on the edge of the incision. The silk handkerchief was cut out in an irregular manner. When the party was requested to place the cap and other articles upon his head in the position in which they were when he was attacked, it was found to be utterly impossible to adjust them,—the incisions could not be made to correspond, and the cap could not be worn over the folded handkerchief. This rendered it certain that the wound had not been inflicted in the manner described. Besides, a blow of a sword which would have divided the felt and silk handkerchief, would at the same time have produced a much deeper wound on the forehead than that which was found. Another instructive case is reported by Dr. Bayard, in which the falsehood of a charge was demonstrated by the want of correspondence between the cuts in the clothes and those found on the person. (Ann. d'Hyg. 1847, ii. 222.)

It has been contended that no rules can be laid down for the detection of such cases: each must be decided by the facts which accompany it. Nevertheless, the details of the cases above mentioned will serve to direct the inquiries of the practitioner.

The facts which he must endeavour to ascertain are the following:—1. The relative positions of the assailant and the assailed person at the time of the alleged attack. 2. The situation, direction, and depth of the wound or wounds. 3. The situation or direction of marks of blood or wounds on the person or dress of either, or of both, the assailant and assailed. 4. The marks of blood, and the quantity effused at the spot where the mortal struggle is alleged to have taken place.

The importance of these inquiries cannot be over-estimated. A strong suspicion was raised against the late Duke of Cumberland, in the year 1810, in reference to the death of *Sellis*, when a proper examination of the wounds would probably have shown that they could not have been self-inflicted.

It is worthy of remark, that imputed wounds are generally *cuts* or *stabs*. They are seldom of the contused kind: the impostor cannot, in reference to contusions, so easily calculate upon the amount of mischief which is likely to ensue.

Pistol-shot wounds are sometimes voluntarily inflicted for the purpose of imputing murder or extorting charity. A man intending to commit suicide by fire-arms, and failing in the attempt, may, out of shame, in order to conceal his act, attribute the wound to the hand of some assassin. In examining such imputed wounds, they will not be found (except in cases of attempted suicide) to involve vital parts; and they will possess all the characters of near-wounds produced by gunpowder, wadding, or a bullet. (See GUN-SHOT WOUNDS.) The skin around will be extensively lacerated and bruised: there will be much ecchymosis, and the hand holding the weapon, as well as the dress and the wounded skin, may be blackened or burnt by the exploded gunpowder. A pistol-shot wound from an assassin may be produced from a distance, while an imputed wound which is produced by a person on himself must always partake of the characters of a near-wound. If the weapon have been charged with gun-cotton, there will be no marks of blackening on the person or dress, but there may be marks of burning.

CHAPTER XXVI.

THE CAUSE OF DEATH IN WOUNDS.—CAUTION ON ASSIGNING TOO MANY CAUSES—WOUNDS DIRECTLY OR INDIRECTLY FATAL—DEATH FROM HEMORRHAGE—LOSS OF BLOOD REQUIRED TO PROVE FATAL—MODIFIED BY AGE AND OTHER CIRCUMSTANCES—FATAL WOUNDS OF SMALL ARTERIES—INTERNAL HEMORRHAGE—DEATH FROM MECHANICAL INJURY TO A VITAL ORGAN—DEATH FROM SHOCK—BLOWS ON THE ABDOMEN—FLAGELLATION—DEATH FROM MULTIPLICITY OF INJURIES WITHOUT ANY MORTAL WOUND—SUBTLE DISTINCTIONS REGARDING THE MORTALITY OF WOUNDS.

Cause of death.—It is important for a medical witness to bear in mind that in all cases of wounds criminally inflicted, the cause of death must be certain. No man is ever convicted upon mere medical probability. In general, there is only *one* real cause of death, although other circumstances may have assisted in bringing about a fatal result. Thus a person cannot die of disease in the bowels and a stab in the chest at the same time, nor of apoplexy from disease and compression of the spinal marrow at the same instant. Hence it is our duty, when several apparent causes for death exist, to determine which was the *real* cause, and in stating it to the Court, to be prepared to offer our reasons for this opinion. In most cases of local injury, when a person dies speedily, there will be no great trouble in settling whether disease or the injury was the cause. A difficulty may, however, exist when a person has recovered from the first effects of a wound, and has subsequently died. Besides, there may be cases in which the cause of death, in spite of the most careful deliberation, will be still obscure; or sometimes it may happen that the death of a party appears to be as much dependent on bodily disease as on an injury proved to have been received at the time he was labouring under disease. How is an opinion to be expressed in such a case? The course which I apprehend a medical witness ought to pursue, provided he has duly deliberated on the circumstances before he appears in Court, and his mind is equally balanced between the two causes, is to state at once his doubt to the jury without circumlocution, and not allow it to be extracted from him in cross-examination. It is the hesitating to assign a satisfactory cause, or the assigning of many causes for death, that gives such advantage to a prisoner's counsel even when the general evidence is entirely against him. Occasionally many causes of death are assigned by a witness, among which some have a tendency to exculpate and others to inculpate the prisoner in a greater or less degree, and it is left to the jury to select from the number one upon which to found a verdict! In a case of this kind an acquittal is commonly obtained.

Wounds directly or indirectly fatal.—A wound may cause death either *directly or indirectly*. A wound operates as a *direct cause of death* when the person dies immediately, or very soon after its infliction; and there is no other cause internally or externally, to account for death. In wounds which cause death *indirectly*, it is assumed that the deceased survives for a certain period, and that the wound is followed by inflammation, suppuration, gangrene, tetanus, erysipelas, or some other mortal disease, which is a direct and not an unusual consequence of the injury. Under this head may be also arranged all those cases which prove fatal by reason of surgical operations rendered imperatively necessary for the treatment of the injury,—presuming that these operations have been performed with ordinary skill and care. We shall for the present consider only the direct causes of death in cases of wounds. These are three in number:—1. *Hemorrhage.* 2. *Great mechanical injury* done to an organ important to life. 3. *Shock*, or concussion, whereby the functions of one or more vital organs are arrested, sometimes with but very slight injury to the part struck or wounded.

From either of these causes, a wounded person may die either immediately or within a very few minutes.

1. *Death from hemorrhage.*—Loss of blood operates by producing fatal syncope. A quantity of blood, however insufficient to cause syncope, may readily destroy life by disturbing the functions of the organ or part into which it is effused. Thus a small quantity poured out in or upon the substance of the brain, may kill by inducing fatal compression; and again, if in a case of wounded throat, blood should flow into the trachea, it may cause death by asphyxia—*i. e.* by stopping the respiratory process. In both of these cases it is obvious that the blood acts mechanically; and in respect to the last, a medical man may, unless circumspection be used, involve himself in a charge of malapraxis. If he allow the wound to remain open, the wounded person may die through hemorrhage,—if he close it too soon, he may die through suffocation; and, in either case, the counsel for the prisoner will not fail to take advantage of a plausible objection of this kind. In wounds of the chest, involving the heart and lungs, death is very frequently due not so much to the actual quantity of blood effused, as to the pressure which it produces upon these organs. A few ounces effused in the bag of the pericardium will entirely arrest the action of the heart.

The absolute *quantity of blood* required to be lost in order to prove fatal must of course vary according to numerous circumstances. The young, the aged—they who are labouring under infirmity or disease, will perish sooner from hemorrhage than others who are healthy and vigorous. Females, *cæteris paribus*, are more speedily destroyed by hemorrhage than males. Infants are liable to die from hemorrhage resulting from very slight wounds. An infant has been known to bleed to death from the bite of a single leech, or from the simple operation of lancing the gums. Even the healthy and vigorous, when their vital powers have been depressed by maltreatment or by brutal violence, will sink under the loss of a comparatively small quantity of blood. (See Watson on Homicide, p. 90.) A medical jurist must not forget that some individuals have a predisposition to hemorrhage; and this condition is often hereditary. The slightest wound or puncture,—the bite of a leech or the extraction of a tooth, will be attended with an effusion of blood which cannot be arrested, and which will slowly lead to death by exhaustion. Cases have been frequently recorded in our medical journals of fatal hemorrhage following the extraction of teeth, when there had been previously nothing to indicate the probable occurrence of death from so trivial a cause. (For striking instances of this remarkable tendency to hemorrhage in a family, see Brit. and For. Med. Rev. xvii. 247; also Med. Gaz. May, 1842.) In the thirty-ninth volume of the latter journal, p. 86, a case is reported by Mr. Druitt, in which a very unusual degree of hemorrhage followed a compound fracture of the leg. Such cases are without difficulty detected, since a surgeon may always infer from the part injured and the extent of the injury, whether the hemorrhage is likely to be copious or not. When a person bleeds to death from what would, under common circumstances, be a simple wound, the admission of this fact may in certain cases lessen the responsibility of an accused party.

[For a large number of American and other cases of this kind, see Beck's Med. Jur. ii. 295, 296, 297.—H.]

A *sudden loss* of blood has a much more serious influence than the same quantity lost slowly. A person may fall into a mortal syncope from a quantity of blood lost in a few seconds, which he would have been able to bear without sinking had it escaped slowly. This is the reason why the wound of an artery proves so much more rapidly fatal than that of a vein. Death speedily follows the wound of a large artery like the carotid; but it takes place with equal certainty, although more slowly, from wounds of smaller arteries. In a case where one of the intercostal arteries was wounded by a small shot, hemorrhage caused death in thirty-eight hours. The hemorrhage which follows the division of the smaller branches of the external carotid, is often sufficient to destroy life unless timely

assistance be rendered. A case was tried at the Berkshire Spring Assizes, 1832, in which it was proved that the prisoner had killed his wife by stabbing her in the leg: the anterior tibial artery was divided, and she died from hemorrhage half an hour afterwards. Wounds of arteries, even smaller than these, might in some subjects prove fatal, if no assistance were at hand. Mr. Watson mentions a case where the internal mammary artery on the left side was divided by a stab in the chest. The woman died on the ninth day, and four pounds of blood were found effused on that side. In another case, where an intercostal artery was divided, six pounds of blood were effused. (Op. cit. 101.) In both of these cases, as in most wounds of the chest, the blood not only affected the system by its loss, but by its compressing the lungs and impeding respiration. Wounds of large veins, such as the jugular, may, from the quantity of blood suddenly effused, speedily destroy life. If the wound be in a very vascular part, although no vessel of any importance be divided, the person may die from hemorrhage. It is difficult to say what quantity of blood should be lost in order that a wound may prove fatal by hemorrhage. The whole quantity contained in the body of an adult is calculated at about one fifth of its weight—*i. e.* about thirty pounds; of this, one-fourth is considered to be arterial, and the remaining three-fourths venous blood. According to Mr. Watson, the loss of from five to eight pounds is sufficient to prove fatal in adults. But while this may be near the truth, many persons will die from a much smaller quantity; the *rapidity* with which the effusion takes place having a very considerable influence. It has been found, by experiment, that a dog cannot bear the loss of more blood than is equivalent to one-twelfth part of the weight of its body.

Internal hemorrhage.—Hemorrhage may prove fatal, although the blood does not escape from the body. In incised wounds, the flow externally is commonly abundant; but in punctured and gun-shot wounds, the effusion may take place internally, and rapidly cause death. In severe contusions or contused wounds, involving highly vascular parts, the effusion may go on to an extent to prove fatal, either in the cavities of the body or throughout the cellular membrane and parts adjacent. Many pounds of blood may in this way become slowly or rapidly extravasated. The means of ascertaining whether a person has died from hemorrhage are these:—Unless the wound be situated in a very vascular part, we shall find the vessel or vessels from which the blood has issued divided,—the neighbouring vessels empty, and the body more or less pallid; although this last condition is of course liable to be met with in certain cases of disease, as also under copious venesection,—points easily determined by an examination. The blood will commonly be found more or less clotted or coagulated on those surfaces on which it has fallen. If, with these signs, there is an absence of disease likely to prove rapidly fatal, and no other probable cause of death be apparent, it may be fairly referred to hemorrhage. This opinion may, however, be materially modified by the fact of the body not being seen on the spot where the fatal wound was actually inflicted,—by the wound having been sponged,—the blood removed by washing, and all traces of hemorrhage destroyed. Under these circumstances, the case must in a great measure be made out by presumptive proof: and here a medical witness may have an important duty thrown upon him, namely, that of examining articles of dress or furniture for marks or stains of blood.

It must not be supposed that all the blood met with around a wounded dead body was actually effused during life. As soon as the heart's action ceases, the arteries pour out no more; but the blood, so long as it remains liquid, *i. e.* from four to eight or ten hours, and the warmth of the body is retained, continues to drain from the divided veins and smaller vessels. The quantity thus lost, however, is not very considerable, unless the veins implicated be large. A question relative to the degree of this post-mortem hemorrhage has very frequently been put in a Court of law.

II. *Death from great mechanical injury done to a vital organ.*—We have

instances of this becoming a direct cause of death in the crushing of the heart, lungs or brain, by any heavy body passing over or falling on the cavities. This severe mechanical injury is sometimes accompanied by a considerable effusion of blood, so that the person really dies from hemorrhage; but in other instances the quantity of blood lost is inconsiderable, and the fatal effect may be referred to shock.

III. *Death from shock.*—This is sometimes a direct cause of death under the infliction of external violence; and in this case life is destroyed without the injury being to all appearance sufficient to account for so speedily fatal a result. There is no medical doubt that a person may die from what is termed shock, without any marks of severe injury being discovered after death. We have examples of this mode of death in accidents from lightning, or from severe burns or scalds, in which the local injury is often far from sufficient to explain the rapidly fatal consequences. As instances of this form of death from violence may be also cited those cases in which a person has been suddenly killed by a blow upon the upper part of the abdomen or epigastrium, which is supposed to operate by producing a fatal impression on the cardiac plexus. Whether this be or be not the true explanation, the fact itself is undisputed; it is certain that a person may die from so simple a cause without any appearance being produced externally or internally to account for death. On the skin, there may be some marks of abrasion or ecchymosis; but, as it has been elsewhere stated, these are neither constant nor necessary accompaniments of a blow. An account of the post-mortem appearances in a case of this kind, by Mr. Wood, will be found in the Med. Gaz. vol. xliv. p. 213. Convictions for manslaughter have taken place, where death has been produced under these circumstances. Concussion of the brain, unattended by mechanical lesion, is another example of this kind of death. A man receives a severe blow on the head; he falls dead on the spot, or becomes senseless and dies in a few hours. On inspection there may be merely the mark of a bruise on the scalp; in the brain, there may be no rupture of vessels or laceration of structure, and all the organs of the body are found healthy. Thus, then, there may be no sign of a mortal injury; and there is apparently no cause to account for death. This can only be referred to the shock or violent impression which the nervous system has sustained from the blow,—an impression which the vital powers are wholly unable to counteract or resist. A medical witness must give his evidence with caution in such cases, since it is the custom to rely in the defence upon the absence of any visible *mortal* wound to account for death,—a principle which, if once unrestrictedly admitted as correct, would leave a large number of deaths, undoubtedly occurring from violence, wholly unexplained. A trial took place at the Liverpool Autumn Assizes, 1837, wherein several persons were charged with manslaughter of the deceased, by kicking him behind the right ear. The medical witness deposed that there was in this spot the mark of a severe contusion, but there was no injury whatever to the brain, and the body was otherwise healthy. He very properly ascribed death to the violent shock given to the nervous system, and the Court admitted that the cause of death was satisfactorily made out. The party who inflicted the wound was convicted.

There is another form of shock which is of some importance in medical jurisprudence. A person may have received *many injuries*, as by blows or stripes, not one of which, taken alone, could, in medical language, be termed mortal; and yet he may die directly from the effects of the violence, either on the spot or very soon afterwards. Death is commonly referred to exhaustion, but this is only another mode of expression; the exhaustion is itself dependent on a fatal influence or impression produced on the nervous system. A prize-fighter after having, during many rounds, sustained numerous blows on the body, may, either at or after the fight, sink and die exhausted. His body may present marks of bruises, or even lacerated wounds, but there may be no internal changes to account for death. In common language, there is not a single injury which can be termed mortal; and yet, supposing him to have had good health previously

to the fight, and that all marks of disease indicative of sudden death are absent, it is impossible to do otherwise than refer his death to the direct effect of the violence. A case of a somewhat similar kind, we have in the military punishment of *flagellation*, which is occasionally followed by death, either as a direct consequence of shock, or from indirect causes, such as inflammation and its consequences. In a case which occurred at Hounslow (July, 1846,) it was considered that the inflammation of the heart and pleura, of which the man had died, had arisen from the disorganized condition of the back, produced by flogging.

It is a well-ascertained medical fact, that a multiplicity of injuries, each comparatively slight, are as capable of operating fatally as any single wound, whereby some blood-vessel or organ important to life is directly affected. Age, sex, constitution, and the previous state of health or disease, may accelerate or retard the fatal consequences. In the case of *Governor Wall*, the judge told the jury that the long continuance and severity of pain (in flagellation) may be productive of as fatal consequences, as if instruments or weapons of a destructive kind were used. On a trial for murder, which took place in Germany a few years since, it was proved that the deceased had been attacked with sticks, and that he had been afterwards flogged on the back with willow-switches. He died in about an hour. On inspection, there was no mortal wound, nor any lesion to a vital organ; there were simply the marks of lacerations and bruises on the skin, apparently not sufficient to account for death; but this was nevertheless very properly referred to the violence. (Henke, Zeitschrift der S. A. 1836.) The case of the *Duchess of Praslin*, who was murdered by her husband in Paris in August, 1847, furnishes an additional proof of the fatal effects produced by numerous injuries. On an inspection of the body, it was found that on the head, neck, and both of the hands, there were no fewer than *thirty* distinct wounds, some contused, and others incised and punctured. There were also the marks of many bruises, and the impressions produced by the nails of the murderer's hand over the mouth. For the most part, these injuries were slight, and not one could be said to be necessarily mortal. The most serious wound was situated on the right side of the neck; but even here the carotid artery and internal jugular vein had escaped injury. Death was referred to the hemorrhage which had taken place from the numerous wounds during the struggle with the assassin. (Ann. d'Hyg. 1847, ii. 377.) From these considerations, it is obviously absurd to expect that in every case of death from violence or maltreatment, there must be some specific and well defined *mortal lesion* to account for that event. When the circumstances accompanying death are unknown, a medical opinion should always be expressed with caution; but if we are informed that the deceased was in ordinary health and vigour previous to the infliction of the violence, and there is no morbid cause to account for his *sudden* illness and death, there is no reason why we should hesitate in referring death to the effects of a multiplicity of injuries. Among non-professional persons, a strong prejudice exists that no person can die from violence unless there be some distinct *mortal* injury actually inflicted on his person. By this we are to understand a *visible* mechanical injury to some organ or blood-vessel important to life; but this is obviously a very erroneous notion, since death may take place from the disturbance of the functions of an organ without this being necessarily accompanied by a perceptible alteration of structure. The prevalence of this popular error often leads to a severe cross-examination of medical witnesses. Among the questions put, we sometimes find the following:—Would you have said, from the wounds or bruises *alone*, that they were likely to have occasioned death? Now, in answer to this, it may be observed, that we cannot always judge of the probability of death ensuing from the appearance of external violence alone. Because these appearances were slight, it would be wrong to infer in every case that they were *not* sufficient to cause death. A man may die from a blow on the epigastrium, and how can this fact be determined by an examination of the body? Then it may be inquired, Were the wounds or bruises mortal? In the vulgar sense of the word, *i. e.* by producing severe hemorrhage

or a destruction of parts, they might not be so; but in a professional view, they may have acted mortally by producing a shock to the nervous system. Or it may be inquired, which of the several wounds or bruises found on the body of the deceased was mortal? The answer to which may be: Not one individually, but *all* contributed to occasion death by exhaustion.

It must likewise be remembered, that in all cases where a person has sustained a number of injuries, the loss of a much smaller quantity of blood than in other instances, will suffice to destroy life. It is sometimes a very difficult question to decide on the relative degree of mortality of wounds, and on the share which they have had respectively in causing death. By a wound being of itself *mortal*, we are to understand that it is capable of causing death directly or indirectly, in spite of the best medical assistance. It is presumed that the body is healthy, and that no cause has intervened to bring about or even accelerate a fatal result. The circumstance of a person labouring under disease when wounded in a vital part, will not, of course, throw any doubt upon the fact of such a wound being necessarily mortal, and of its having caused death. If there should be more wounds than one, it is easy to say, from the nature of the parts involved, which was likely to have led to a fatal result. In order to determine, on medical grounds, whether a wound was or was not mortal, we may propose to ourselves this question: Would the deceased have been likely to die at the same time, and under the same circumstances, had he not received the wound? There can obviously be no general rule for determining the mortal nature of wounds. Each case must be judged by the circumstances which attend it. In some parts of the Continent, the law requires that a medical witness should draw a distinction between a wound which is *absolutely* and one which is *conditionally mortal*. An absolutely mortal wound is defined to be that where, the best medical assistance being at hand, being sent for, or actually rendered, the fatal event could not be averted. Wounds of the heart, aorta, and internal carotid arteries, are of this nature. A conditionally mortal wound is one where, had medical assistance been at hand, been sent for, or timely rendered, the patient would, in all probability, have recovered. Wounds of the brachial, radial, and ulnar arteries may be taken as instances. The responsibility of the assailant is made to vary according to which of these classes the wound may be referred by the medical witnesses; and, as it is easy to suppose, there is seldom any agreement on the subject. Our criminal law is entirely free from such subtleties. The *effect* of the wound, and the *intent* with which it was inflicted, are looked to: its anatomical relations, which must depend on pure accident, are never interpreted in the prisoner's favour. Some extenuation might, perhaps, be occasionally admitted when a wound proves mortal through an indirect cause, as inflammation or fever, and medical advice was obtainable, but not obtained until every hope of recovery had disappeared. It would appear, however, from the case of The *Queen* v. *Thomas* and others (Gloucester Aut. Ass. 1841,) that the mere neglect to call in medical assistance is not allowed to be a mitigatory circumstance in the event of death ensuing. The deceased died from the effects of a severe injury to the head inflicted by the prisoners, but had had no medical assistance. The judge said it was possible that "if he had had medical advice, he might not have died; but whoever did a wrongful act must take the whole consequences of it. It never could make any difference whether the party injured had or had not the means or the mind to apply for medical advice." The prisoners were convicted. According to Lord Hale, if a man be wounded, and the wound, although not in itself mortal, turn to a gangrene or fever for want of proper applications, or from neglect, and the man die of gangrene or fever, this is homicide in the aggressor; for though the fever or gangrene be the immediate cause of death, yet the wound being the cause of the gangrene or fever, is held the cause of death, *causa causati*. These nice questions relative to the shades of responsibility for personal injuries, occasionally arise in those cases where individuals have been wounded at sea on board of a ship in which there was no surgeon.

CHAPTER XXVII.

CHEMICAL EXAMINATION OF BLOOD-STAINS—ACTION OF THE TESTS ON ORGANIC AND INORGANIC RED COLOURING MATTERS—STAINS OF BLOOD ON LINEN AND OTHER STUFFS—DATE OF THE STAINS—EVIDENCE FROM THE DETECTION OF FIBRIN—INSOLUBLE STAINS RESEMBLING BLOOD—RED PAINT MISTAKEN FOR BLOOD—SOLUBLE STAINS OF FRUITS, FLOWERS, ROOTS, AND EXTRACTS—REMOVAL OF BLOOD-STAINS FROM ARTICLES OF CLOTHING—STAINS OF BLOOD ON WEAPONS—CITRATE OF IRON MISTAKEN FOR BLOOD—DISTINCTION OF STAINS FROM IRON-RUST—COLOUR FROM RED DYES—BLOOD OF MAN AND ANIMALS—EVIDENCE FROM THE ODOUR—MICROSCOPICAL EVIDENCE—FORM AND SIZE OF THE RED GLOBULES IN MAMMALIA AND OTHER CLASSES.

Examination of blood-stains.—It might appear at first sight a very easy matter to say whether certain suspected spots or stains on articles of clothing, furniture, or weapons, were or were not due to blood; but in practice, great difficulty is often experienced in answering the question. If the stains be recent, most persons may be competent to form an opinion; but the physical characters of blood are soon changed, even when the stuff is white and otherwise favourable to an examination. Again, when the stains, whether recent or of old standing, are upon dark-dyed woollen stuffs, as blue, black, or brown cloth, or when they appear in the form of detached spots or thin films on a rusty weapon, no one but a professional man should be allowed to give an opinion. It is, however; by no means unusual to find questions put to policemen respecting the nature of suspected stains!—a practice obviously unjust to the accused, and fraught with considerable danger.

Chemical analysis.—There is no direct chemical process by which blood can be identified, but we presumptively establish its nature by determining the presence and properties of the red colouring matter or *hæmatosine*. The microscope may be most usefully employed in these medico-legal investigations, when chemistry fails to aid the practitioner; the value of this branch of evidence will be presently considered. The chemical properties of the red colouring matter of blood are as follow:—1. The colouring matter of blood readily combines with *distilled water*, forming, if recent, a rich red solution. 2. The red colour of this solution is neither turned of a crimson nor of a green tint by a few drops of a solution of *ammonia:* if the ammonia be very concentrated, or added in large quantity, the red liquid acquires a brownish tint. 3. The liquid when *boiled* is coagulated,—the red colour is entirely destroyed, and a muddy brown flocculent precipitate is formed,—the quantity of which will depend on the quantity of colouring matter and albumen present. 4. The coagulum produced by boiling, when collected on a filter and dried, forms a black resinous-looking mass, quite insoluble in water, but readily soluble in boiling *caustic potash*, forming a green-coloured solution. This is not an important criterion. 5. To the above tests some have united the action of strong nitric acid, which coagulates the red colouring matter, turning it of a dirty brown hue. M. Boutigny has suggested the application of these tests, by taking advantage of the spheroidal state of liquids on red-hot metals (Ann. d'Hyg. 1844, ii. 217.) Such are the chemical properties of blood, whether derived from the body of man, or from any red-blooded animal.

Objections to the tests.—It will now be proper to mention the action of the tests upon other red colouring matters, extracted from the animal or vegetable kingdom. Some of these are turned green by ammonia, as the colouring matter of the *rose*,—others crimson, as the red colouring matters of *cochineal*, logwood, and *lac*. None of these red colours are coagulated or destroyed by boiling. In these respects, therefore, the colouring matter of the blood is eminently distin-

guished from them. M. Raspail has objected that a mixture of *madder* and albumen possesses all the characters assigned to blood. Having for some years past performed numerous experiments on this subject, by making artificial mixtures of human serum or animal albumen, with the red colouring matters of cochineal, lac, and madder, and neutralizing the effects of the alkali contained in the serum by the addition of a small quantity of acetic acid, I feel justified in stating that in no respect whatever, except in regard to colour, can such mixtures be confounded with blood. The objection is, therefore, more theoretical than practical. These red liquids may easily deceive those who trust to a *red colour* alone; and herein we see the absolute necessity for placing the investigation of such subjects in the hands of professional persons only. It may be observed of all such artificial mixtures, that they are changed by ammonia to a crimson or a green tint (sometimes passing through a blue,) and that under no circumstances is the red colour destroyed by boiling the solution in water. The albumen of serum, if in sufficient quantity, becomes coagulated, but the coagulum still retains the red colouring matter locked up within it. In the case of blood, the effect of heat is widely different. Those vegetable colouring principles which are not affected by ammonia (kino and catechu) are readily known by the application of heat. The colour is not coagulated and destroyed like the red colour of blood. (See Guy's Hosp. Reports, October, 1851.) It was formerly supposed by some chemists that the blood owed its colour to the presence of *sulphocyanate of iron*. When this mineral compound is mixed with albumen or serum in water, in a certain proportion, the resemblance to a solution of the colouring matter of blood is so great, that from appearance only, it would be impossible to distinguish them. The effects of the application of heat are, however, widely different. A coagulum is formed in the albuminous solution of the sulphocyanate of iron, but the red colour is not destroyed by boiling. It becomes only of a somewhat lighter tint.

Stains of blood on linen and other stuffs.—Supposing the stuff to be white or nearly colourless, the spot of blood, if recent, is of a deep red colour; but it becomes of a reddish brown, or of a deep brown by keeping. The change of colour to a reddish brown I have found to take place in warm weather in less than twenty-four hours. After a period of five or six days, it is scarcely possible to determine the date of the stain even conjecturally. In a large stain of blood on linen, no change took place during a period of five years:—it had a brown colour at the end of six weeks, which it retained for the long period mentioned. Indeed, it is extremely difficult in any case, after the lapse of a week, to give an opinion as to the *actual date* of a stain. Upon coloured stuffs it is of course impossible to trace these physical changes in stains of blood,—on red-dyed stuffs the stain of blood appears simply darker from the first, and in all cases the fibre of the stuff is more or less stiffened. Attention should be paid to the side of the stuff, if an article of dress, which has first received the stain: sometimes both sides (if it be an apron or a stocking) are stained. The evidence derived from an observation of this kind may be occasionally of importance.

Analysis.—In order to determine whether the stain be due to blood, we cut a slip of the stained part of the linen, and suspend it by a thread in a small test-tube containing a small quantity of distilled water. After a few minutes, or a few seconds, should the stain be recent, a red liquid will be seen falling in fine dark threads, and collecting at the bottom of the test-tube, giving a red colour to the lower stratum of water; and a dark red-brown colour, if it be of old standing. The separation may not take place in less than an hour, if the stuff be thick and coarse, or not readily pervious to water. When the stain is on silk it is speedily separated. Several slips of the stuff may be thus successively treated, until a liquid, sufficiently deep in colour for testing, is procured. If the quantity of coloured liquid thus obtained be small, the supernatant clear water may be carefully poured off; but it is better to use a small tube and a small quantity of water. The liquid may then be tried by weak ammonia, and

by the application of heat. If ammonia produce any effect upon the solution of blood, it is simply to brighten it,—this alkali never changes the red colour to *green or crimson*. When the stain is of old standing, the solution in water is more slowly obtained, and does not present the bright red colour of blood. The action of ammonia may also be obscure, although it never gives to the liquid a green or crimson tint. The action of *heat* is in such cases certain and effectual: if the coloured solution be in such small quantity that there is no coagulum obtained by heat, it is impossible to give a decided opinion, from the application of chemical tests, that the stain is due to blood. In May, 1838, a piece of linen was examined in which there were two faint spots of blood, each about one quarter of an inch in diameter. A reddish-coloured liquid was procured, but no coagulum could be obtained on boiling. In these ambiguous cases we must resort to the use of the microscope. When the quantity of blood effused is moderately large, it may be easily detected by the above process—even after the lapse of a great length of time. I have thus detected the blood of the human subject, and of the bullock, on cotton, linen, and flannel, after the lapse of *three years*. If the stuff be dyed, we should proceed to examine it in the same way. Thus, then, in testing for blood, we rely upon—1, the ready solubility of the hæmatosine (or red colouring matter) in water; 2, the negative action of ammonia; and 3, the positive effect of heat in entirely coagulating and destroying the red colouring matter.

Objections.—It may, however, be objected, that red stains closely resembling blood are occasionally found on linen and other stuffs. It is to be remarked of all such stains, that they are either entirely *insoluble* in cold water or they are *soluble*. If insoluble, they cannot by any possibility be mistaken for blood. It is very true, that if the linen or stuff which is stained with blood be heated to a high temperature, the colouring matter may, by its having become coagulated, be rendered insoluble in water:—but it is not probable that medical evidence will be thus defeated, except by those who have made a profound study of the difficulties of medical jurisprudence. In the case of a body found wounded and burnt, it would be proper to allow for such a change, and the chemical evidence would fail. If the blood-stain be mixed with oil or grease, this will interfere with the action of water. If the stain be on a plaster-wall or on wood, we must scrape or cut out a portion, and digest it in a small quantity of water in a tube or watch-glass. It will be proper here to examine well, in the first instance, an unstained portion of the plaster or wood.

Detection of fibrin.—In this process for examining blood-stains, it has not been thought necessary to refer to the properties of *fibrin*. Fibrin forms about 1-500th part of human blood: it exists in the blood of all warm-blooded animals: the other animal liquids in which it is found are the chyle and lymph. It is the chief constituent of muscular fibre. When the blood is in sufficient quantity, a pale film of fibrin may be left upon the stained substance, after the colouring matter has been removed by digestion in water. Small quantities of fibrin are not easily identified by its chemical properties. Animal fibrin so closely resembles coagulated albumen and gluten, that it cannot be distinguished from them by chemical tests. Hence, unless evidence of the presence of red colouring matter be obtained, the presence of fibrin cannot be relied on; and if this evidence be obtained, the demonstration of its properties is unnecessary; for there is no red colouring matter which, under due precautions, can be mistaken for that of blood. Evidence on this subject was tendered in the case of *Reg.* v. *Reed* (York Winter Assizes, 1847,) but it was not well received by the Court. It has been supposed that the demonstration of the presence of fibrin in a blood-stain would enable us to say whether the blood had been effused from the living or dead body; but, admitting that the existence of fibrin in a small quantity of dried blood upon an article of dress could be indisputably established, the fact would not enable us to give a conclusive answer to the important question above

suggested. If the quantity of blood examined be comparatively great, and no fibrin can be procured from it after complete digestion in cold water, it is probable that this blood has not come from a living body, and that it is merely a mixture of red colouring matter and serum, like that found in the vessels of the dead body after perfect coagulation. But the experimentalist must bear in mind that small stains of blood will commonly leave no perceptible traces of fibrin. On the other hand, if fibrin were clearly obtained, it would be by no means proved that the blood yielding it had issued from a *living* body. Until the blood has coagulated, it retains fibrin; and coagulation seldom commences in the dead body until after the lapse of four hours; although, if drawn, it speedily consolidates. Hence the dress of a person sprinkled with blood from a recently dead body, would yield all the characters of stains which had been produced by the effusion of blood from a wound inflicted on the living body. (See, on the subject of blood-stains, Ann. d'Hyg. 1829, 267, 548; 1830, 433; 1831, 467; 1833, 226, ii. 160; 1834, 205; 1835, ii. 349; 1839, i. 219; 1840, i. 387; also Henke's Zeitschrift der S. A. 1844, ii. 273. See also for a full account of this subject, Guy's Hosp. Reports, Oct. 1851.)

Insoluble stains.—Among what may be classed as insoluble stains are—1, certain *red dyes*, as madder, which, when fixed by a mordant, is not readily affected by ammonia. 2. *Iron-moulds.* These are of a reddish-brown colour, sometimes of a bright red,—they are quite insoluble in water, but are easily dissolved by diluted muriatic acid, and on adding ferrocyanide of potassium to the muriatic solution, the presence of iron will be at once apparent. Care should be taken that the muriatic acid used for this purpose contains no iron. The stained article of dress should also be proved to be free from any iron-dye, or a blood-stain might be erroneously pronounced to be due to iron. Some years since, a man was found drowned in the Seine, at Paris, under suspicious circumstances. The body had evidently lain a long time in the water. On examining the shirt of the deceased, a number of red-brown stains were observed on the collar and body,—resulting, as it was supposed, from spots of blood, which had become changed by time. On a chemical examination, however, they were found to be iron-moulds produced by the corrosion of a steel-chain which the deceased had worn round his neck! 3. *Red paint.* Stains made with red paint have been mistaken for blood. In March, 1840, a person was murdered at Islington. An individual was arrested on suspicion, and in his possession was found a sack, having upon it many red stains, which were supposed to be dried and coagulated blood. They were examined by Professor Graham, who found that they had been caused by red paint, containing *peroxide of iron;* and the sack was proved to have been worn as an apron by a youth who was an apprentice to a paper-stainer. It had been sent to the accused party a few days before, as a wrapper to a parcel. The accused was immediately discharged. Stains of this kind may be easily known by digesting them in diluted muriatic acid, and applying to the solution the tests for iron. Like those produced by iron-moulds, they are perfectly insoluble in water, and therefore cannot be confounded with blood-stains. The same may be said of spots of the ammonio-nitrate of silver changed by light, which I have known to be mistaken for old stains of blood. The stuff on which the spots of blood are found may be itself stained with a red dye or colour, or it may be dyed with iron: in this case it will be necessary to test by the same process a piece of the coloured or stained portion, in order to furnish negative evidence that the suspected stains are due to blood. In *Spicer's* case (ante, p. 196,) an apron which the prisoner wore was found with stains of blood upon it; but the greater part was covered with dark-red stains, which turned out to be owing to a logwood dye that the prisoner had used in his business. (Med. Gaz. xxxvii. 613.)

Soluble stains.—Among the soluble stains resembling those of blood are the spots produced by juices of the *mulberry, currant,* and other *red fruits.* These are commonly recognised by dropping on them a solution of ammonia, when the

spot is turned either of a bluish or olive-green or crimson colour. This crimson colour, in very diluted solutions, is sometimes only slowly developed on the addition of ammonia or potash. A spot of blood thus treated undergoes no change from the alkali. Further, if a piece of the stained stuff be suspended in water, the coloured liquid, if any be obtained, is easily known from blood by its acquiring a green or crimson tint on the addition of ammonia, and by the red colour not being *coagulated* or destroyed when the liquid is *boiled*. Independently of the fruits mentioned, there are many vegetable juices that will produce stains of a red or red-brown colour, which might be mistaken for blood. In the following case, the red petals of flowers gave rise to an error only removed by a proper examination. A farmer's lad was arrested upon a charge of murder. The blue blouse and trowsers which he wore had on them numerous brown and red stains resembling blood, and apparently produced by the wiping of bloody fingers. The stained articles were subjected to a chemical examination, and it was found that the colour was caused by some vegetable juice. The accused, when interrogated on the subject, stated, that the day before his arrest he had collected a large quantity of red poppies, which had become bruised by his trampling on them, and that he had carried them home in his blouse. The apparently suspicious circumstance was thus explained away. Bayard, Man. Prat. de Méd. Lég. 271. Several varieties of *sonchus*, according to this writer, produce stains which might be mistaken for blood.

In some red stuffs, the dye is often so bad, that water will dissolve out a portion of the colour; but in this case the action of ammonia and heat will serve readily to distinguish the stains from blood. If minute spots be scattered on articles of furniture, these may be examined by cutting out the stained portions, and treating them in the way just mentioned. It is said that blood-stains, when minute and scattered, are more readily recognised and identified by the light of a candle than in the light of day. I do not know that much reliance can be placed on this statement. The brown stains appear to acquire a redder tint.

The soluble red or brown stains given by woods or roots, such as *Logwood*, *Brazil-wood*, or *Madder-root*, are changed to a *crimson* colour by ammonia.—They also generally contain tannic acid, and acquire a dark olive-green colour when a persalt of iron is added to the liquid. Red-brown extracts, such as *Kino* and *Catechu*, are not affected by ammonia; but the colour given to water is different from that of blood, and the addition of a persalt of iron reveals the presence of tannic acid. For a further account of the differences between red dyes and blood, see Guy's Hospital Reports, October, 1851.

Removal of blood-stains.—It is not unfrequent that an attempt is made by a murderer to wash out blood-stains, so that the colour is lost, and no chemical evidence can be obtained. It is a common notion that certain chemical agents will remove or destroy these stains; but this is not the case,—the colour may be altered, but it is not discharged or bleached. Chlorine, a most powerful discolorizing agent, turns the colouring matter of blood of a green-brown colour. Hypochlorous acid has a similar effect. This acid has been recommended as useful by its bleaching properties for distinguishing the stain of blood from all other stains, except those produced by iron-rust. Orfila has, however, shown that this is not fitted for such a purpose, and that there are no better methods of testing than those above described. (Ann. d'Hyg. 1845, ii. 112.) I have found that nothing removes a blood-stain so effectually as simple maceration in cold water; although, when the stain is old, the process is sometimes slow. On an important trial for murder, at the Shrewsbury Lent Assizes, 1841, (The *Queen* against *Misters*,) this question as to the power of certain reagents in discharging stains of blood, was raised. Alum was traced to the possession of the prisoner; it was found dissolved in a vessel in his bed-room, and it was supposed that he had removed some blood-stains from his shirt by the use of this salt. Two medical witnesses deposed that they had made experiments, and had found that alum

would take the stains of blood out of linen:—according to one, sooner than soap and water. The results of my experiments do not correspond with these. I have not found that alum extracts stains of blood so readily as common water, and when alum is added to a solution of hæmatosine in water, so far from the colour being discharged, it is slowly converted to a deep greenish-brown liquid. In one experiment, a slip of linen, having upon it a deep stain of dried blood of old standing, was left in a solution of alum for twenty-four hours; but not a particle of the red colouring matter had been extracted, although it was changed in colour. The prisoner's guilt did not rest on this point alone,—that was made sufficiently evident from other circumstances; but there have been few cases tried in England where the facts connected with the analysis of blood-stains were so closely examined, or of such great importance, as in this. In a case to be presently related, I was consulted as to whether the alkali contained in yellow soap would alter or remove blood-stains. The effect of this substance, as well as of potash, soda, and their carbonates, is to change the red colour of blood to a deep greenish-brown, like many other reagents,—but they do not exert on it any discharging or bleaching power. Combined with friction, blood-stains may of course be easily effaced by any *cold* alkaline or soapy liquid.

Examination of weapons.—Before the coagulum is removed from a weapon it should be examined carefully by the microscope. Hairs or fibres, or other substances, may be found imbedded in the solidified blood either on the edge or on the blade; and evidence of this kind may occasionally be of great importance. In the case of *Reg.* v. *Harrington*, Essex Lent Assizes, 1852, a razor was produced in evidence, with which it was alleged the throat of the deceased had been cut. I examined the edge microscopically, and separated some small fibres from a coagulum of blood, which under a high magnifying power turned out to be cotton fibres. It was proved at the trial that the assassin, in cutting the throat of the deceased while lying asleep, had cut through one of the strings of her cotton nightcap. This was a strong circumstance to show that the razor produced was the weapon with which the fatal wound had been inflicted.

Stains of blood on weapons.—When recent, and on a polished instrument, stains of blood are easily recognised; but when of old standing, or on a rusty piece of metal, it is a matter of some difficulty to distinguish them from the stains produced by rust or other causes. If the stain of blood be large, a portion will readily peel off on drying. This may be placed in a watch-glass of distilled water, filtered to separate any oxide of iron, and then tested. If the water by simple maceration do not acquire a red or red-brown colour, the stain is *not* due to blood. Sometimes the stain appears on a dagger or knife either in the form of a thin yellowish or reddish film, or in striæ, and is so superficial that it cannot be mechanically detached. We should then pour a stratum of water on a piece of plate-glass, and lay the stained part of the weapon upon the surface. The water slowly dissolves any portion of the colouring matter of blood, and this may be examined in the way recommended. If the weapon have been exposed to heat, this mode of testing will fail.

Objections.—There is often a remarkable resemblance to the stains of blood on metal produced by the *oxide or certain vegetable salts of iron.* If the juice or pulp of lemon or orange be spread upon a steel blade, and remain exposed to air for a few days, the resemblance to blood produced by the formation of *citrate of iron* is occasionally so strong, that I have known well informed surgeons to be completely deceived:—they have pronounced the spurious stain to be blood, while the real blood-stain on a similar weapon was pronounced to be artificial. This difficulty of distinguishing such stains by the eye is well illustrated by a case which occurred in Paris a few years since. A man was accused of having murdered his uncle, to whose property he was heir. A knife was found in his possession, having upon it dark-coloured stains, pronounced by those who saw them to be stains of blood. M. Barruel, and another medical jurist, were re-

quired to determine the nature of these stains, and the examination was made before a magistrate in the presence of the accused. They were clearly proved, by these and other experiments, to be spots produced by the citrate of iron. It appeared on inquiry, that the knife had been used by some person a short time previously, for the purpose of cutting a lemon; and not having been wiped before it was put aside, a simple chemical action had gone on between the acid and the metal, which had given rise to the appearance. This case certainly shows that physical characters alone cannot be trusted to in the examination of these suspected stains. Stains of the *citrate of iron* may be thus known. The substance is soluble in water, forming, when filtered, a yellowish-brown solution, totally different from the red colour of blood under the same circumstances. The solution undergoes no change of colour on the addition of ammonia. It is unchanged in colour, but may be partially coagulated at a boiling temperature; and it is at once identified as a salt of iron, by giving a blue colour with the ferrocyanide, and a deep red with sulphocyanide of potassium. I have also observed, that spots of the citrate of iron on knives, for they are not found on other weapons, are often soft and deliquescent, while those of blood are commonly dry and brittle.

It might be supposed to be a very simple matter to distinguish by sight a stain of blood on a weapon from a mark produced by *iron-rust:* but this is not the case. When suspicion exists, it is astonishing how readily mistakes are made; and marks are pronounced to be due to blood, which, under other circumstances, would have passed unnoticed. One source of difficulty is this: the iron-rust is often mixed up with articles of food on an old knife, or even with blood itself. We must here pursue the same mode of examination as if the stain were of blood; we macerate the weapon or a portion of the coloured deposit in a small quantity of distilled water, and filter the liquid. If the stain be due to iron-rust, this is separated by filtration, and the liquid comes through colourless. The absence of blood is thereby demonstrated: for I need not here consider the objection, that the weapon may have been exposed to heat, and thus have rendered the blood-stain insoluble in water. If we now digest the brown undissolved residue left on the filter, in diluted muriatic acid free from iron, we shall obtain a yellowish solution, which will give with the ferrocyanide and sulphocyanide of potassium the proper reactions for iron. It has been recommended to put muriatic acid on the stain as it exists on the weapon, and then to test the liquid, as the red spot of rust is soon removed by the acid; but the objection to this is, that a spot containing blood may be thereby pronounced to be one of rust only, since muriatic acid, in all cases, dissolves a portion of the iron, and the solution would therefore give the characters of an iron-stain with the tests. In all old blood-stains, when the weapon is rusty, blood and oxide of iron are intermixed. The blood may be easily separated by digesting the compound in distilled water and filtering: this is dissolved, and passes through, while the rust is left on the filter.

The following case was referred to me for examination a few years since. A man was suspected of murder, and some stains existed on his shirt, which were supposed to have been produced by blood. Around the collar and upper part of the shirt, there was a large and somewhat deep pinkish-red stain, in some respects resembling washed blood. This I considered as a very unusual situation for blood to be found sprinkled; and upon trying the stained linen by the processes mentioned, the colour entirely resisted separation by water, and was turned of a slight crimson tint by ammonia. The stain was thus shown not to be due to blood. On inquiry, it was ascertained that the man had worn round his neck a common red handkerchief during a wet night, and while taking violent exercise! The stain was thus accounted for. There were, however, some other marks on the shirt which required examination, as there was a very strong suspicion against this man. These were on the sleeves, at those parts which would be likely to receive stains of blood if they had been rolled or turned up at the

wrists; and it was clearly ascertained, that the murderer, in this case, had washed his hands, using a quantity of yellow soap. These stains were of a brownish colour, without any shade of red; they were faint in parts and diffused, conveying the impression that an attempt had been made to wash them out. So far as external characters were concerned, it was difficult to say whether they had been produced by blood or not. On examining those parts of the shirt corresponding to the armpits, stains precisely similar were there seen, evidently resulting from cutaneous perspiration, since the suspicion of blood being poured out on this part of the shirt under the circumstances, could not be entertained. Slips of linen from the stained portions of the sleeves were digested in water. In twenty-four hours the stains were entirely removed; and the lower stratum of water in each tube had acquired a straw-yellow colour. There was not the least shade of a red or brown tint; and the solution was wholly unlike that produced by blood under any circumstances. The solution was unaffected by ammonia, as well as by a heat of 212°; but it gave a faint opalescence on the addition of nitric acid. These results not only indicated the absence of blood, but showed that the stains were due to cutaneous perspiration, acting on a dirty skin, and through a dirty dress. The stains on the part corresponding to the axillæ could not be ascribed to blood; and from the similarity in physical and chemical properties, it was impossible to attribute those on the sleeves to any sanguineous effusion. It so happened, however, that a large pocket-knife, with numerous dark-red stains on the blade and between the layers of the handle, was found upon this man, and this was also sent for examination. Several persons who saw the knife pronounced a strong opinion that the marks were due to blood. The stains were composed of some soft viscid matter, which gave out ammonia when heated, and left a residue of peroxide of iron. On digesting the matter in water no portion was dissolved; and it was, therefore, evident that they were due, not to blood, but to a mixture of some animal matter, probably food, with iron-rust. These results were somewhat in the man's favour,—at least, they removed what was considered to be a strong circumstantial proof of his guilt. He was subsequently tried for the murder, and acquitted on an alibi, established by the evidence for the prosecution.

Conclusions.—From the foregoing remarks, we may justly infer that the chemical analysis of suspected spots or stains on weapons and clothing is by no means a trivial or unimportant duty. If we cannot always obtain from these experiments affirmative evidence, they often furnish good *negative* proof, and thus tend to remove unjust suspicions against accused parties. There is one circumstance, however, of which a medical jurist is entitled to complain, namely, that evidence should be received on matters of this kind from non-professional persons, or that any confidence should be placed in an opinion derived from physical characters only. On the occasion of the murder of *Eliza Grimwood*, in June, 1838, committed, as it was, under circumstances of the greatest mystery, and the perpetrator of which has not yet been discovered, the examination of suspected marks resembling blood became rather an important part of the inquiry, but it was most improperly conducted. The finger-plates of the door of the room, in which the murder was perpetrated, presented some dark stains, supposed to have been produced by the bloody hand of the murderer in the act of escaping. The only test to which these were submitted was, that the magistrate before whom the case was heard tried to rub off some of the stains with a piece of blotting-paper, but did not succeed; and he expressed his opinion, that if they were blood-stains they had been wiped! It is easy to perceive to what evil results superficial examinations of this kind may lead.

Varieties of blood.—The means of distinguishing *arterial* from *venous* blood, available to the medical jurist, have been elsewhere described (see ante, p. 202.) There is no method known by which the blood of a man can be distinguished from that of a woman, or the blood of a child from that of an adult. The blood

of the child at birth contains less fibrin, and forms a thinner and softer coagulum than that of the adult. The medico-legal question has arisen on more than one occasion, whether there were any means of distinguishing *menstrual* blood from that of the body generally. This liquid contains fibrin, red colouring matter, and the other constituents of blood. The only differences noticed are of an accidental kind:—1st, that it is acid, owing to its admixture with vaginal mucus; and 2d, that under the microscope it is mixed up with epithelial scales, which it has derived from its passage through the vagina. (Donné, Cours de Microscopie, 139.) A case occurred recently in France, which induced the Minister of Justice to refer the consideration of this question to the Academy of Medicine. The reporters, MM. Adelon, Moreau, and Le Canu, came to the conclusion, that, in the present state of science, there were no means of distinguishing menstrual blood from that which might be met with in a case of infanticide or abortion. (Ann. d'Hyg. 1846, i. 181.)

Blood of man and animals.—Test by odour.—When marks of blood have been detected on the dress of an accused person, it is by no means unusual to find these marks referred to his having been engaged in killing a pig or a sheep, or handling fish or dead game. Of course every allowance must be made for a statement like this, which can only be proved or disproved by circumstances; but an important question here arises, namely, whether we possess any means of distinguishing the blood of a human being from that of an animal. M. Barruel, and other French medical jurists, state, that by mixing fresh blood with one-third or one-half of its bulk of strong sulphuric acid, and agitating the mixture with a glass rod, a *peculiar odour* is evolved, which differs in the blood of man and animals, and also in the blood of the two sexes. This odour, it is said, resembles that of the cutaneous exhalation of the animal, the blood of which is made the subject of experiment. They have hereby pretended to determine, whether any given specimen of blood belonged to a man, a woman, a horse, sheep, or fish. Others assert that they have been enabled by this process to identify the blood of frogs and fleas! (See Devergie, Méd. Lég. ii. 907.) Now it is certain, that an excess of strong sulphuric acid does give rise to a particular odour when mixed with blood, probably owing to its decomposing some of the animal principles of this liquid; it is also possible that some persons may discover a difference in the odour, if not according to the sex, at least according to the animal, —but even this point is far from being established; and if it were admitted, there is probably not one individual among a thousand whose sense of smelling would be so acute as to allow him to state, with *undeniable certainty*, from what animal the unknown blood had really been taken. Any evidence short of this would not be received in an English Court of law; for it is considered better not to decide at all, than to decide on principles which are exposed to unavoidable fallacy. Besides, it must be remembered, that in general the operator has not before him the blood, but merely a very diluted solution of the colouring matter mixed with a small quantity of serum. (For additional remarks on this subject, see paper in Guy's Hospital Reports, Oct. 1851.)

Hæmatalloscopy.—Within a recent period, M. Taddei, of Florence, has suggested another process for distinguishing human from animal blood, and the varieties of animal blood from each other. He calls this process hæmatalloscopy (*αιμα αλλοιον σκοπειν.*) It is of the most complex kind, and essentially depends on varying degrees of *fluidifiability* of blood in different animals. By the addition of an artificially prepared compound, mixed with sulphuric acid, he alleges that he has been able to distinguish human from animal blood, and to fix measurable degrees of fluidifiability so as to allow an opinion to be expressed. Even if the complexity of the process were not a sufficient objection to its employment, the results, as he describes them, are so vague and unsatisfactory as to render it wholly inapplicable to practical purposes. An account of the process will be found in [the Second Part (Chimie Médicale) of] Briand's Manuel Complet de Médecine Légale, 1846, 745. [See also same, 5th ed., 1852, 795.—H.]

Detection of blood by the microscope.—The red corpuscles which characterise the blood of the mammalia appear to resist the ordinary changes of putrefaction. A dog was strangled in September, 1851. A portion of blood was taken soon after death from the vena cava. About a drachm of the serum containing some of the red colouring matter was kept in a corked phial, and examined at intervals during a period of nine months. In June, 1852, the corpuscles were again examined, and it was found that although the blood was dark-coloured and highly offensive, the corpuscles still retained their perfect shape and size without any apparent alteration.

Microscopical evidence.—The microscope has been of late years employed not only to distinguish blood from other coloured liquids, but for drawing a distinction between the blood of different classes of animals. The red colouring matter of blood consists of globules or particles floating in a clear liquid: they are in the human subject about the 1-3500th of an inch in diameter, but they vary somewhat in size in the same blood. If, then, globules be clearly detected, there can be no doubt that the liquid is blood: but it appears to me that it would be unsafe to rely upon microscopical observation only, except where the individual has been much habituated to examine blood by this instrument. In preparing the stain for the microscope, water must not be used, as this alters the form of the globules, and ultimately destroys them. Albumen or serum, *free from globules*,—a solution of white sugar of sufficient density to prevent endosmosis (1.03,) or a solution of sulphate of soda of similar density, should be employed for the maceration of the clot, coagulum, or stained portion of stuff; and when the liquid has acquired a red tinge by contact, a drop of the coloured liquid may be placed between two plates of glass, and examined. A portion of the stuff, or, what is better, if it can be obtained, a small portion of *dried blood* detached from it, should be placed on a clean glass slide, and covered with a few drops of a solution of white sugar. [A lump of white sugar dissolved in a wine-glassful of water will give a liquid of sufficient density.] In about half an hour or an hour, the red-brown liquid, having a thin piece of microscopic glass placed over it, may be examined by a power of about 250 diameters. Globules more or less spherical in form, and of a very faint reddish colour by daylight, may be then seen floating in the liquid. These are the blood-globules or corpuscles, and they are immediately recognised by their peculiar characters. By this process I lately obtained clear evidence of their existence in and separation from a minute fragment of dried blood which had been kept in a dried state for a period of *three years*. Hence there is scarcely any limit to the period at which the microscope may be made available for this species of evidence.

The microscope does not enable us to distinguish with certainty *animal from human blood—i. e.* the globules in the class mammalia are so similar to each other in form and size, that it would be impossible to say whether the blood was that of a sheep, bullock, or human being. The red globules vary in size: thus, in the human subject the average size is 1-3500th of an inch; but they are found both larger and smaller in the same individual, and they are of the same size in the embryo and fœtus as in the adult. In the blood of a human adult I have found the globules to vary from a maximum size of 1-2000th of an inch to a minimum size of 1-5000th of an inch, thus comprising the sizes of nearly all the mammalia. In the elephant, they appear to have the maximum size among mammalia, being, on an average, 1-2745th of an inch in diameter. In all animals with red blood they have a disc-like or flattened form. In the mammalia, excepting the camel tribe, these discs have a *circular* outline; in this tribe, and in birds, fishes, and reptiles, they have the form of a lengthened ellipse, or *oval*. In the three last-mentioned classes of animals, the globules have a central nucleus, which gives them an apparent prominence in the centre. The blood-globules of all the mammalia, including the camel tribe, have no central nucleus, and the globule appears depressed. The globules in reptiles are, comparatively speaking, very large;

thus, in the frog, the largest diameter is not less than the 1-1100th of an inch. If water, or any liquid of less specific gravity than serum, be employed in these experiments, the flattened discs of the mammalia, and the elliptical discs of birds, fishes, and reptiles, become spherical, and a distinction can no longer be drawn. (For further information on this subject, see Donné, Cours de Microscopie; Bayard, Man. Pratique de Méd. Lég. 270; and Hassall's Microscopical Anatomy, 66, 118: also Guy's Hosp. Reports, Oct. 1851.) [See also Briand, Man. Compl. de Méd. Lég. 5th Ed., 1852, 803.—H.]

The microscope, therefore, in the hands of a competent observer, may show that a liquid is blood, and also whether the blood be derived from the class mammalia, or from a bird, fish, or reptile. It has been alleged that the microscopical detection of fibrin with the blood-globules would indicate that the blood came from a *living* person by its possessing a coagulating power; but the blood would present exactly the same appearance if drawn from the body many hours after death. (Donné, op. cit. 52.) Nevertheless, where the blood remains liquid, as in the dead body, the form of the globules undergoes a rapid change, especially in certain morbid states. Donné has observed that even prior to death they sometimes become shrivelled, mis-shapen, and irregular in outline. (Op. cit. 77.) There is no doubt, however, that, so long as an unbroken clot or coagulum can be procured from the *stained* article of dress, there may be a reasonable expectation of demonstrating by the microscope whether the stain be or be not owing to blood. The value of the instrument for this purpose has been fully made known by Dr. Carl Schmidt. ("Die Diagnostik verdächtiger Flecke in Criminalfällen," Leipzig, 1848. See, also, a paper by Dr. Butler Lane, Med. Times, Dec. 21, 1850.)

CHAPTER XXVIII.

DEATH OF WOUNDED PERSONS FROM NATURAL CAUSES—DISTINCTION BETWEEN REAL AND APPARENT CAUSE—DEATH FROM WOUNDS OR LATENT DISEASE—ACCELERATING CAUSES. —WHICH OF TWO WOUNDS CAUSED DEATH?—DEATH FOLLOWING SLIGHT PERSONAL INJURIES.

Death of wounded persons from natural causes.—It is by no means unusual for individuals who have received a wound, or sustained some personal injury, to die from latent natural causes; and as, in the minds of non-professional persons, death may appear to be a direct result of the injury, the case can only be cleared up by the assistance of a medical practitioner. Such a coincidence has been witnessed in many instances of attempted suicide. A man has inflicted a severe wound on himself while labouring under disease; or some morbid change, tending to destroy life, has occurred subsequently to the infliction of a wound, and death has followed. Without a careful examination of the body, it is impossible to refer death to the real cause. The importance of an accurate discrimination in a case where a wound or personal injuries have been caused by another, must be obvious on the least reflection; a hasty opinion may involve an accused party in a charge of manslaughter; and, although a barrister might be able to show on the trial that death was probably attributable not to the wound, but to coexisting disease, yet it must be remembered, that the evidence of a surgeon before a coroner, in remote parts of this country, may be the means of causing the accused to remain incarcerated for a period of five, six, or seven months previously to the trial. This is in itself a punishment, independently of the loss of character, to which an accused party must be in the mean time exposed.

In Guy's Hospital Reports, Oct. 1850, p. 230, will be found two cases communicated to me by Mr. Procter of York, in which death from natural causes was wrongly assigned to violence. In a very instructive case, reported by Dr. Berncastle (Lancet, Feb. 15, 1845, 185,) the deceased, a boy, died, from internal strangulation of the intestine from morbid causes, after wrestling with another boy, who might, but for the inspection, have been erroneously charged with having caused his death. For a similar case, see Medical Gazette, xxxvii. 702. An instance is related by Dr. Neumann, in which the question was, however, doubtful. (See Casper's Wochenschrift, May 24, 1845.)

Death from wounds or latent disease.—It must be borne in mind by a practitioner, that numerous causes of death may be lurking within the system at the time that a wound is criminally inflicted, and a close attention to the symptoms and post-mortem appearances can alone assist him in the difficult position in which he may be placed, should the accused party be subsequently brought to trial. A man may be severely wounded, and yet death may take place from rupture of the heart, the bursting of an aneurism, from apoplexy, phthisis, or other morbid causes which it is here unnecessary to specify. (Cormack's Ed. Journal, May 1846, 343.) If death can be clearly traced to any of these diseases by an experienced surgeon, the prisoner cannot be charged with manslaughter; for the medical witness may give his opinion that death must have taken place about the same time and under the same circumstances, whether the wound had been inflicted or not. On these occasions, however, one of the following questions would probably arise:—Was the death of the party accelerated by the wound, or was the disease under which he was labouring so aggravated by the wound as to produce a more speedily fatal termination? The answer to either of these questions must depend on the circumstances of the case, and the witness's ability to draw a proper conclusion from these circumstances. The maliciously accelerating of the death of another already labouring under disease is criminal; for what accelerates, causes. Lord Hale, in remarking upon the necessity of proving that the *act* of the prisoner caused the death of the party, says:—"It is necessary that the death should have been occasioned by some corporeal injury done to the party by force, or by poison, or by some *mechanical means* which occasion death; for although a person may, in *foro conscientiæ*, be as guilty of murder by working on the passions or fears of another, and as certainly occasion death by such means, as if he had used a sword or pistol for the purpose, he is not the object of temporal punishment." (I. 247.) Several acquittals have taken place of late years, where the deaths of parties have been occasioned by terror or dread of impending danger, produced by acts of violence on the part of the prisoners; not, however, giving rise to bodily injury in the deceased. Conformably to Lord Hale's view, the Criminal Law Commissioners, in their report on the subject of homicide, state:—"Art. 1. The law takes no cognizance of homicide unless death result from bodily injury occasioned by some act or *unlawful omission*, as contradistinguished from death occasioned by an influence on the mind, or by any disease arising from such influence. Art. 2. The terms 'unlawful omission' comprehend every case where any one being under legal obligation to supply food, clothing, or other aid and support, or to do any other act, or make any other provision for the sustentation of life, is guilty of any breach of such duty."

Under the new statute (14 and 15 Vict. cap. 100,) the necessity for tracing death to some *corporeal* injury appears to be practically abolished. According to the fourth section, in any future indictment for murder or manslaughter, it shall not be necessary to set forth the *manner* in which or the *means* by which the death of the deceased was caused.

Which of two wounds caused death?—It is possible that a man may receive *two wounds* on provocation, at different times, and from different individuals, and die after the receipt of the second: in such a case, the course of justice may require that a medical witness should state which wound was the cause of death.

Let us take the following illustration:—A man receives during a quarrel a gun-shot wound in the shoulder. He is going on well, with a prospect of recovery, when in another quarrel he receives a severe penetrating wound in the chest or abdomen from another person, and after lingering under the effects of these wounds for a longer or shorter period, he dies. If the gun-shot wound were clearly shown to have been the cause of death, the second prisoner could not be convicted of manslaughter; or if the stab were evidently the cause of death, the first prisoner would be acquitted on a similar charge. It might be possible for a surgeon to decide the question summarily, as where, for instance, death speedily follows the second wound, and, on inspection of the body, the heart or a large vessel is discovered to have been penetrated; or, on the other hand, extensive sloughing, sufficient to account for death, might take place from the gun-shot wound, and on inspection, the stab might be found to be of a slight nature, and not involving any vital parts. In either of these cases, all would depend upon the science and skill of the medical practitioner,—his evidence would be so important that no correct decision could be come to without it; he would be, in fact, called upon substantially to distinguish the guilty from the innocent. On some occasions, death may appear to be equally a consequence of either or both of the wounds; in which case, probably, both parties would be liable to a charge of manslaughter. (See Ann. d'Hyg. 1835, ii. 482.) The second wound, which is here supposed to have been the act of another, may be inflicted by the wounded party on himself, in an attempt at suicide, or it may have an accidental origin. The witness would then have to determine whether the wounded party died from the wound inflicted by himself, or from that which he had previously received.

It may happen that the wounded person has taken *poison*, and actually died from the effects of this, and not from the injuries or maltreatment. A case of this kind has been already related. Again, the wounded person may have been the subject of further ill treatment, and the question will be put as to which of the two causes his death was really due. It is to be observed of these cases, that the supervening disease, the poison, or the subsequent ill treatment, should be of such a nature as to account for *sudden or rapid death;* since it would be no answer to a charge of death from violence, to say that there were marks of chronic disease in the body, unless it were of such a nature as to account for the sudden destruction of life under the symptoms which actually preceded death. In the medical jurisprudence of wounds, there is probably no question which so frequently presents itself as this: it is admitted that the violence was inflicted, but it is asserted that death was due to some other cause; and the onus of proof lies on the medical evidence. Among numerous cases which have occurred in England during the last twelve years, I find that the latent causes of death in wounded persons have been chiefly inflammation of the thoracic or abdominal viscera, apoplexy, diseases of the heart and large blood-vessels, phthisis, ruptures of the stomach and bowels from disease, internal strangulation, and the rupture of deep-seated abscesses. In some of these cases the person was in a good state of health up to the time of the violence, and in others there was a slight indisposition. The history is nearly the same in all:—it was only by careful conduct on the part of the medical witnesses that the true cause of death was ascertained. It is obvious that questions of malapraxis and life insurance, giving rise to civil actions, may have a very close relation to this subject.

Death following slight personal injuries.—An imputation has often been thrown on the masters of schools, where boys have died soon after they have been chastised. In such cases there has been commonly some unhealthy state of the body to explain this result. When the disease which gives rise to doubt is seated in a part which is remote from that which sustained the violence, all that is required is, that the post-mortem examination of the body should be conducted with ordinary care. If the disease should happen to be in the part injured, the case becomes much more perplexing. The difficulty can then be re-

moved only by attentively considering the ordinary consequences of such injuries. The violence may have been too slight to account for the diseased appearance; and the disease itself, although situated in the part injured, may be regarded as a most unusual consequence of such an injury.

CHAPTER XXIX.

WOUNDS INDIRECTLY FATAL — DEATH FROM WOUNDS AFTER LONG PERIODS — SECONDARY CAUSES OF DEATH — THE CAUSE IS UNAVOIDABLE — THE CAUSE AVOIDABLE BY GOOD MEDICAL TREATMENT — COMPARATIVE SKILL IN TREATMENT — CAUSE AVOIDABLE BUT FOR IMPRUDENCE ON THE PART OF THE WOUNDED PERSON — ABNORMAL OR UNHEALTHY STATE OF BODY — ACCELERATION OF DEATH.

Wounds indirectly fatal.—Certain kinds of injuries are not immediately followed by serious consequences, but the individual may perish after a longer or shorter period of time, and his death may be as much a consequence of the injury as if it had taken place on the spot. The aggressor, however, is just as responsible as if the deceased had been directly killed by his violence, provided the fatal result can be traced to the usual and probable consequences of the injury. Wounds of the head are especially liable to cause death insidiously,—the person may in the first instance recover, he may appear to be going on well, when, without any apparent cause, he will suddenly expire. It is scarcely necessary to observe, that in general a post-mortem examination of the body will suffice to determine whether death is to be ascribed to the wound or not. In severe injuries affecting the spinal marrow, death is not an immediate consequence, unless that part of the organ which is above the origin of the phrenic nerves be wounded. Injuries affecting the lower portion of the spinal column do not commonly prove fatal until after some time; but the symptoms manifested by the patient during life, as well as the appearances observed in the body after death, will sufficiently connect the injury with that event. Death may follow a wound, and be a consequence of that wound, at almost any period after its infliction. It is necessary, however, in order to maintain a charge of homicide against an individual, that death should be strictly and clearly traceable to the injury, and not be dependent on any other cause. A doubt on this point must, of course, lead to an acquittal.

Death from wounds after long periods.—Many cases might be quoted, in illustration of the *length of time* which may elapse before death takes place from certain kinds of injuries,—the injured party having ultimately fallen a victim to their indirect consequences. One of the most striking instances of this kind is that related by Sir A. Cooper, of a gentleman of Yarmouth, who died from the effects of an injury to the head received about *two years* previously. In this case, the connexion of death with the wound was clearly made out by the continuance of the symptoms of cerebral disturbance during the long period which he survived.

There is a singular rule in our law relative to the period at which an individual dies from a wound—namely, that a party shall not be adjudged guilty of homicide unless death take place *within a year and a day* after the infliction of a wound. (Archbold, 845.) In practice, the existence of this rule is of little importance, but in principle it is erroneous. Most wounds leading to death generally destroy life within two or three months after their infliction:—sometimes the person does not die for five or six months, and, in more rare instances, death does not ensue until after the lapse of twelve months, or even several years.

These protracted cases occur especially in respect to injuries of the head. Strict justice demands that the responsibility of a person who has inflicted a wound should depend upon this having really caused death, and not upon the period at which death takes place; for this must be a purely accidental circumstance.

Secondary causes of death.—An individual who recovers from the immediate effects of a wound may die from fever, inflammation or its consequences, erysipelas, tetanus, or gangrene; or an operation required during the treatment of the wound may prove fatal. These are what may be called secondary causes of death, or secondary consequences of the wound. The power of deciding on the responsibility of an accused person for an event which depends only in an indirect manner on the injury originally inflicted by him, rests of course with the authorities of the law. But it is impossible that they can decide on so difficult and nice a question without satisfactory medical evidence; and on the other hand, it is right that a medical witness should understand the importance of the duty here required of him. Fever or erysipelas may follow many kinds of serious wounds, and in some few instances be distinctly traceable to them; but in others, the constitution of the patient may be so broken up by dissipated habits as to render a wound fatal which in a healthy subject might have run through its course mildly and have healed. When the fever or erysipelas is readily to be traced to the wound, and there is no other apparent cause of aggravation to which either of these disordered states of the body could be attributed, they can scarcely be regarded by the medical practitioner as very unexpected or unusual consequences of such injuries, especially when extensive, or when seated in certain parts of the body, as the scalp. If death takes place under these circumstances, the prisoner would be held as much responsible for the result as if the wound had proved directly mortal. This principle has been frequently admitted by our law, and, indeed, were it otherwise, many reckless offenders would escape, and many lives would be sacrificed with impunity. It is, however, difficult to lay down general rules upon a subject which is liable to vary in its relations in every case; but when a wound is not serious, and the secondary cause of death is evidently due to constitutional peculiarities from acquired habits of dissipation, the ends of justice are probably fully answered by an acquittal; in fact, such cases do not often pass beyond a coroner's inquest.

These secondary causes of death may be arranged under the following heads:—

1. *The cause is unavoidable.*—Of this kind are tetanus, following laceration of tendinous and nervous structure,—erysipelas following lacerated wounds of the scalp,—peritoneal inflammation following rupture of the bladder or intestines, with extravasation of their contents,—strangulation of the intestines, as phrenic hernia following rupture of the diaphragm, and others of the like nature. Here, supposing proper medical treatment and regimen to have been pursued, the secondary cause of death was unavoidable, and the fatal result certain.

2. *The cause avoidable by good medical treatment.*—There are, it is obvious, many kinds of wounds which, if properly treated in the first instance, may be healed, and the patient recover; but when improperly treated, they may prove fatal. In the latter case, it will be a question for the witness to determine, how far the treatment aggravated the effects of the violence, and from his answer to this, the jury may have to decide on the degree of criminality which attaches to the prisoner. Let us suppose, for instance, that an ignorant person has removed a clot of blood, which sealed up the extremity of a vessel, in consequence of which fatal hemorrhage has ensued,—or that he has produced death by unnecessarily interfering with a penetrating wound of the thorax or abdomen,—it would scarcely be just to hold the aggressor responsible, since, but for the ignorance and unskilfulness of his attendant, the wounded party might have recovered from the effects of the wound. When death is really traceable to the negligence or unskilfulness of the person who is called to attend on a wounded party, this circumstance ought to be, and commonly is, admitted in mitigation, supposing

that the wound was not originally of a mortal nature. Lord Hale observes: "It is sufficient to constitute murder, that the party dies of the wound given by the prisoner, although the wound was not originally mortal, but became so in consequence of negligence or unskilful treatment; but it is otherwise where death arises not from the wound, but from unskilful applications or operations used for the purpose of curing it." (I. 428.) The medical jurist will perceive that a very nice distinction is here drawn by this great judge, between death as it results from a wound rendered mortal by improper treatment, and death as it results from the improper treatment, irrespective of the wound. In the majority of cases such a distinction could scarcely be established, except upon conjectural grounds, and in no case, probably, would there be any accordance in the opinions of medical witnesses. In slight and unimportant wounds, it might not be difficult to distinguish the effects resulting from bad treatment from those connected with the wound, but there can be but few cases of severe injury to the person, wherein a distinction of this nature could be safely made; and the probability is, that no conviction for murder would now take place, if the medical evidence showed that the injury was not originally mortal, but only became so by unskilful or improper treatment. In such a case, it would be impossible to ascribe death to the wound, or to its usual or probable consequences,—and without this it is not easy to perceive on what principle an aggressor could be made responsible for the result.

3. *Comparative skill in treatment.*—If the death be owing to the wound, it signifies not that under more favourable circumstances, and with *more skilful treatment*, the fatal result might have been averted. As a proof of this, the following case, reported by Alison, may be quoted:—The prisoner was one of the party of smugglers who fired at an officer of excise. The wounded man was carried to the nearest village, where he was attended by the surgeon of the country, who was not deficient in attention, but a great collection of matter having formed in the leg, fever ensued, and the patient died at the end of three weeks. In defence, it was urged that, by *skilful* treatment, the man might have recovered, but the Court held that it was incumbent to prove that death arose *ex malo regimine*. The true distinction in all such cases is, that if the death was evidently occasioned by grossly erroneous medical treatment, the original author of the violence will not be answerable; but if it arise from the want merely of the higher skill which can only be commanded in great towns, he will be responsible, because he has wilfully exposed the deceased to a risk from which he has practically no means of escaping. (150.) In the case of *Macewan* (Perth Sept. Circ. 1830,) the prisoner was indicted for the manslaughter of a boy, by striking him a blow on the shoulder, which dislocated the arm. Two days after the blow, an ignorant bone-setter was consulted, and owing to his manipulations, inflammation took place, and the boy being of a sickly and scrofulous habit, this proved fatal. Under the direction of Lord Meadowbank the prisoner was acquitted. In charging the grand jury in reference to *Mr. Seton's* case, (Winchester Aut. Ass. 1845,) Mr. Baron Platt is reported to have observed, that if a man inflicted a wound likely to produce death, and the wounded party should fall into the hands of an unskilful practitioner, whereby death was hastened, the aggressor would still be responsible for the result. If the wound had not been likely to produce death, but by unskilful treatment death ensued, then that would not be murder.

It will be obvious that a serious responsibility is thrown on practitioners who undertake the management of a case of criminal wounding. Any deviation from common practice should therefore be made with the greatest caution, since novelties in practice will, in the event of death, form one of the best grounds of defence in the hands of a prisoner's counsel. On these occasions, every point connected with the surgical treatment will be rigorously inquired into. In the case of a severe lacerated wound to the hand or foot, followed by fatal tetanus, it may

be said that the wounded person would not have died, had amputation been performed. In this instance, however, a practitioner may justify himself by showing either that the injury was too slight to require amputation, or that the health or other circumstances connected with the deceased, would not allow of its being performed with any fair hope of success. On the other hand, if the practitioner performed amputation, and the patient died, then it would be urged that the operation was unjustifiable and had caused death. Here the surgeon is bound to show that the operation was necessary according to the ordinary rules of treatment. The treatment of severe incised wounds of the throat, where the trachea is involved, sometimes places a practitioner in a very embarrassing position. If the wound be left open, death may take place from hemorrhage; if it be prematurely closed, the blood may be effused into the trachea, and cause death by suffocation.

4. *The cause avoidable but for imprudence or neglect on the part of the wounded person.*—A man who has been severely wounded in a quarrel may obstinately refuse medical assistance, or he may insist upon taking exercise, or using an improper diet, contrary to the advice of his medical attendant, or, by other imprudent practices, he may thwart the best conceived plans for his recovery.

The neglect to call in a medical practitioner, or the refusal to receive medical advice, will not, however, according to the decision in the case of *Reg.* v. *Thomas*, (Gloucester Aut. Assizes, 1841,) be considered a mitigatory circumstance in favour of the prisoner, even although the wound was susceptible of being cured. A man may receive a lacerated wound of an extremity, which is followed by tetanus or gangrene, and thus prove fatal: he may have declined receiving medical advice, or have obstinately refused amputation, although proposed by his medical attendant; but this would not be received as a mitigatory circumstance on the part of a prisoner, because the wounded party is not compelled to call for medical assistance, or to submit to an operation, and the medical witness could not always be in a condition to swear that the operation would have positively saved his life; he can merely affirm that it might have afforded the deceased a chance of recovery. In the case of The *Queen* v. *Hulme*, (Liverpool Aut. Assizes, 1843,) it was proved that the deceased had died from tetanus, caused by an injury to a finger some time before. Amputation was advised by the surgeon, but the deceased would not consent to the operation. The prisoner was convicted of manslaughter, and sentenced to the severest punishment prescribed by the law for that crime.

5. *The cause avoidable but for an abnormal or unhealthy state of the body of the wounded person.*—Wounds which are comparatively slight sometimes prove indirectly fatal, owing to the person being in an unhealthy state at the time of their infliction. In bad constitutions, compound fractures or slight wounds, which in a healthy subject would have a favourable termination, are followed by gangrene, fever, or erysipelas, proving fatal. Here the responsibility of an assailant for the death may become reduced, so that although found guilty of manslaughter, a mild punishment might be inflicted. The consequence may be, medically speaking, unusual or unexpected, and, but for circumstances wholly independent of the act of the accused, would not have been likely to destroy life. In general, in the absence of malice, this appears to be the point to which the law closely looks, in order to make out the responsibility of the accused—namely, that the fatal secondary cause must be something not unusual or unexpected as a consequence of the particular injury; and the medico-legal question presents itself under this form: Would the same amount of injury have been likely to cause death in a person of ordinary health and vigour? Men who have suddenly changed their habits of living, and have passed from a full diet to abstemiousness, are unable to beat up against comparatively slight injuries, and often sink from the secondary consequences. So a man otherwise healthy labouring under hernia, may receive a blow in the groin, attended with rupture of the intestine, gangrene, and death,—another with calculus in the kidney may be

struck in the loins, and die in consequence of the calculus perforating the renal vessels, and causing fatal hemorrhage, or from subsequent inflammation.

Acceleration of death.—It must be evident that there exist numerous other internal diseases, such as aneurism, and various morbid affections of the heart and brain, which are liable to be rendered fatal by *slight* external violence. Now, the law, as applied to these cases, is thus stated by Lord Hale:—"It is sufficient to prove that the death of the party was accelerated by the malicious act of the prisoner, although the former laboured under a mortal disease at the time of the act." (I. 428.) In those cases where a slight degree of violence has been followed by fatal consequences, it is for a jury to decide, under all the circumstances of the case, upon the actual and specific intention of the prisoner at the time of the act which occasioned death. And, according to Starkie, "it seems that in general, notwithstanding any facts which tend to excuse or alleviate the act of the prisoner, if it be proved that he was actuated by prepense and deliberate malice, and that the particular occasion and circumstances upon which he relies were sought for and taken advantage of merely with a view to qualify actual malice, in pursuance of a pre-conceived scheme of destruction, the offence will amount to murder." In most of these cases there is an absence of intention to destroy life; but the nature of the wound, as well as the means by which it was inflicted, will often suffice to develope the intention of the prisoner. An accurate description of the injury, if slight, may afford strong evidence in favour of a prisoner, since the law does not so much regard the means used by him to perpetrate the violence, as the actual intention to kill, or to do great bodily harm. Serious injury, causing death by secondary consequences, will admit of no exculpation when the prisoner was aware, or ought to have been aware, of the condition of the party whom he struck. Thus, if a person notoriously ill, or a woman while pregnant, be violently maltreated, and death ensue from a secondary cause, the assailant would be held responsible; because he ought to have known that violence of any kind to persons so situated must be attended with dangerous consequences. So, if the person maltreated be an infant, or a decrepit old man, or one labouring under a mortal disease, it is notorious that a comparatively slight degree of violence will destroy life in these cases; and the prisoner would properly be held responsible. A wound which *accelerates* death *causes* death, and may therefore render the aggressor responsible for murder or manslaughter, according to the circumstances. The Commissioners lately appointed to define the criminal law on the subject of homicide thus express themselves:—"Art. 8. It is homicide, although the effect of the injury *be merely to accelerate the death* of one labouring under some previous injury or infirmity, or although, if timely remedies or skilful treatment had been applied, death might have been prevented." This is conformable to the decisions of our judges. According to Lord Hale, if a man have a disease which in all likelihood would terminate his life in a short time, and another give him a wound or hurt which hastens his death, this is such a killing as constitutes murder. (Archbold, 345.)

CHAPTER XXX.

WOUNDS INDIRECTLY FATAL. TETANUS FOLLOWING WOUNDS—CAUSES OF—DEATH FROM SURGICAL OPERATIONS—PRIMARY AND SECONDARY CAUSES OF DEATH—UNSKILFULNESS IN OPERATIONS—NECESSITY FOR THE OPERATION—ERYSIPELAS FOLLOWING OPERATIONS.

Tetanus following wounds.—This disease frequently presents itself as a secondary fatal consequence of wounds,—more especially of those which are lacerated or contused, and affect nervous or tendinous structures. It has often occurred as a result of very slight bruises or lacerations, when the injury was so

superficial as to excite no alarm; and it is a disease which gives no warning of its appearance. Dr. Brady met with a case in which a man slipped in walking, and fell flat on his back. He was stunned, but able to walk home. He apparently recovered from the simple accident, but on the following day he was attacked with tetanus, and died in seventy hours. (Lancet, May 15, 1847, 516.) In the case of *Reg.* v. *Butcher* (Warwick Lent Assizes, 1848,) it was proved by the medical evidence that the deceased had received a blow on the nose, which caused severe hemorrhage. In spite of good surgical treatment, the man was attacked with tetanus on the fifteenth day, under which he sank. On inspection, it was found that one of the small bones of the nose had been broken, and this had given rise to the fatal attack. Tetanus may come on spontaneously, *i. e.* independently of the existence of any wound on the body. Many cases have been brought into the London hospitals, where the only cause of this disease appeared to be exposure to cold or wet,—or, in some instances, exposure to a current of air. (Lancet, Dec. 14, 1844, 351.) Dr. Watson met with a case in which tetanus appeared in a very severe form in a man who had received no wound, but who had been simply exposed to cold and wet. (Cormack's Monthly Journal, Dec. 1845, 902.) It has sometimes come on without any apparent cause. It is scarcely possible to distinguish, by the symptoms, tetanus from wounds from that which occurs spontaneously as a result of natural causes. In endeavouring to connect its appearance with a particular wound or personal injury, it will be proper to observe—1, whether there were any symptoms indicative of it before the maltreatment;—2, whether any probable cause could have intervened to produce it, between the time of its appearance and the time at which the violence was inflicted;—3, whether the deceased ever rallied from the effects of the violence. The time at which tetanus usually makes its appearance, when it is the result of a wound, is from about the third to the sixth day.

Death from surgical operations.—In the treatment of wounds, surgical operations are occasionally resorted to, and a wounded person may die either during the performance of the operation, or from its after-consequences. A question then arises, whether the party who inflicted the wound can be held responsible for the fatal result. The law regards a surgical operation as part of the treatment, and if undertaken *bonâ fide*, and performed with reasonable skill, the aggressor will be held responsible, whatever may be the result. The necessity of the operation, and the mode of performing it, will be left to the operator's judgment. As the defence may turn upon the operation having been performed unnecessarily and in a bungling and unskilful manner, it will be right for a practitioner, if possible, to defer it until he has had the advice and assistance of other practitioners. According to Lord Hale, if death takes place from an *unskilful operation*, performed for the cure of a wound, and not from the wound, the responsibility of the prisoner ceases; but this eminent lawyer does not appear to have contemplated that death might take place as a consequence of the most skilful operation required for the treatment of a wound, and yet be wholly independent of the wound itself.

Should an operation be unnecessarily or unskilfully performed, the responsibility of an aggressor would, it is presumed, cease, if the death of a wounded party could be clearly ascribed to it. Thus, if in carelessly bleeding a wounded person, the brachial artery should be laid open (see Ann. d'Hyg. 1834, ii. 445,) or if in performing amputation, a large artery be improperly secured, so that the patient in either case die from hemorrhage, the prisoner could not be equitably held responsible; because it would be punishing him for an event depending on the unskilfulness of the medical practitioner. From an *obiter dictum* of Mr. Baron Platt (p. 229) it would appear that the prisoner will be held responsible, if the original wound were likely to produce death, although unskilfully treated. Supposing the bleeding or amputation to be performed with ordinary care and skill,—and yet, in the one case phlebitis, and in the other tetanus, gangrene, or fever, should destroy life, the prisoner will be liable for the consequences. The

practice of the law is strictly consistent with justice. Should the operation be considered to be *absolutely* required for the treatment of a wound, which according to all probability would prove mortal without it,—should it be performed with ordinary skill, and still death ensue as a direct or indirect consequence, it is only just that the prisoner should be held responsible for the result. It is presumed in these cases, that were the patient left to himself, he would, in all probability, die from the effects of the wound. If, therefore, a surgeon, knowing that an operation would give a chance of saving life on such an occasion, did not perform it, it might be contended in the defence, that the deceased had died, not from the wound, but from the incompetency and neglect of his medical attendant. Hence it follows, that if during this very necessary treatment, unforeseen, though not unusual causes, cut short life, no exculpation should be admissible, if it went to attack the best-directed efforts made for the preservation of life. (See Ann. d'Hyg. 1835, i. 231.)

Erysipelas following operations.—When a wounded person is taken to a hospital in which gangrene or erysipelas is diffusing itself by infectious propagation, and he is attacked by one of these diseases before or after the performance of an operation, and dies, a prisoner may be held responsible for the fatal result. It might be contended, that the transportation of the wounded man to such a locality was not absolutely necessary to the preservation of his life; and that he would not then have died, but for the accidental presence of an infectious disease. Cases of this kind cannot be easily decided by general rules; but the question has already been raised before a legal tribunal, in a trial which took place at the Maidstone Lent Assizes, 1839. (*The Queen* against *Connell and others.*) The deceased was assaulted by a number of soldiers, and received two blows on the head with a stick. The wound was not of any great extent, and the deceased did not appear to suffer much from it. Two days afterwards, he was attacked by *erysipelas* in the head and face, and he died in about a week. On inspection, there was no appearance of disease. The surgeon referred death to erysipelas, which was prevalent in the hospital at the time the deceased was brought in. The man would probably have recovered but for the attack of erysipelas, and he did not think that he would have been attacked by that disease but for the wound. Erysipelas was an infectious disease, and a common consequence of wounds of the head. Under this evidence the prisoners were convicted.

Questions relative to responsibility in death following operations would come more frequently before Courts of law, were it not that the cases are stopped in the Coroners' courts by a verdict of accidental death. (See Med. Gaz. xix. 157.) It unfortunately happens that on these occasions there is great difference of opinion among medical witnesses respecting the connexion of the disease with the death, or, indeed, the necessity for the operation itself. The evidence of opinion in favour of the prosecution is sometimes exactly balanced by that urged in the defence; and under these circumstances, the only alternative left to the Court, is to discharge the accused. Differences of opinion upon these subjects among eminent members of the profession tend to convey to the public the impression that there are no fixed principles upon which medical opinions are based; and, consequently, that it would be dangerous to act upon them. Thus it is that we are accustomed to hear of a medical prosecution and a medical defence, as if the whole duty of a medical jurist consisted in his making the best of a case, on the side for which he happens to be engaged,—adopting the legal rule for suppressing those points which are against him, and giving an undue prominence to others which may be in his favour. This is an unfortunate condition of things, for which at present there appears to be no other remedy than that of appointing a Medical board of competent persons to whom such questions might be referred, in the same way as questions relative to navigation are referred by the Admiralty Courts to a board formed of members of the Trinity House,—professionally acquainted with the matters in litigation. [See "Thoughts on Malpractice," by William W. Wood, M.D., Am. Journ. Med. Sci. Oct. 1849.—H.]

CHAPTER XXXI.

CICATRIZATION OF WOUNDS—EVIDENCE FROM CICATRICES—CHANGES IN AN INCISED WOUND—IS A CICATRIX ALWAYS A CONSEQUENCE OF A WOUND?—ARE CICATRICES, WHEN ONCE FORMED, INDELIBLE?—CHARACTERS OF CICATRICES—MEDICAL EVIDENCE RESPECTING THE PERIOD AT WHICH A WOUND WAS INFLICTED—CHANGES IN CONTUSIONS—HOW LONG DID THE DECEASED SURVIVE THE WOUND?

Cicatrization of wounds.—The period of time at which a particular wound was inflicted may become a medico-legal question, both in relation to the living and dead. The identity of a person, and the correctness of a statement made by an accused party, may be sometimes determined by an examination of the wound or its cicatrix. So, if a dead body be found with marks of violence upon it, and evidence adduced that the deceased was maltreated at some particular period before his death, it will be necessary for a practitioner to state whether, from the appearance of the injuries, they could or could not have been inflicted at or about the time. A case was tried at the Taunton Spring Assizes, 1841 (*The Queen* against *Raynon*,) wherein evidence of this kind served to disprove the statement made by the accused. He was charged with maliciously cutting and wounding the prosecutrix. There was a cut upon his thumb, which he accounted for by saying it was from an accident that had occurred three weeks before. The medical witness declared, on examining it, that it could not have been done more than two or three days, which brought the period of its infliction to about the time of the murderous assault. This and other circumstances led to his conviction.

An *incised* wound inflicted on the living body gradually heals by adhesion when no circumstances interfere to prevent the union of the edges. For eight or ten hours the edges remain bloody,—they then begin to swell, showing the access of inflammation. If the parts be not kept well in contact, a secretion of a serous liquid is poured out for about thirty-six or forty-eight hours. On the third day this secretion acquires a purulent character. On the fourth and fifth days, suppuration is fully established, and it lasts five, six, or eight days. A fibrous layer, which is at first soft and easily broken down, then makes its appearance between the edges:—this causes them gradually to unite, and thus is produced what is termed a *cicatrix*. Cicatrization is complete about the twelfth or fifteenth day, when the wound is simple, of little depth, and only affecting parts endowed with great vitality. The length of time required for these changes to ensue will depend—1. On the situation of the wound,—wounds on the lower extremities are longer in healing than those on the upper part of the body. If a wound be situated near a joint, so that the edges are continually separated by the motion of parts, cicatrization is retarded. 2. On the extent. Wounds involving many and different structures are longer in healing than those simply affecting the skin and muscles. 3. On the age and health of the wounded party;—the process of cicatrization is slow in those who are diseased or infirm. In an incised wound, the cicatrix is generally straight and regular; but it is semilunar if the cut be oblique. It is soft, red, and tender, if cicatrization be recent: it is hard, white, and firm, if of long standing. On compressing the skin around an old cicatrix, its situation and form are well marked by the blood not entering into it on removing the pressure. It has been said that the cicatrices of incised wounds are linear, but that is not always the case; in general, they are more or less elliptical, being wider in the centre than at the two ends,—this appears to be due principally to the elasticity of the skin and the convexity of the subjacent parts: thus it is well known that in every wound on the living body the edges

are much separated in the centre, and this physical condition influences the process of cicatrization. When the wound is in a hollow surface, or over a part where the skin is not stretched, as in the armpit or groin, then the cicatrix may be linear or of equal width throughout. If there were any loss of substance in an incised wound, or if the wound were lacerated or contused, the cicatrix would be irregular, and the healing would proceed by granulation. The process might here occupy five, six, or eight weeks, according to circumstances. When healed, the cicatrix would be white, and have a puckered appearance; the surface of the skin would be uneven. (See an essay on this subject by Dr. Krügelstein, Henke's Zeitschrift der S. A. 1844, ii. 75.)

Is a cicatrix always a consequence of a wound?—If we here use the term wound in the sense in which it is commonly employed in jurisprudence,—*i. e.* where the breach of continuity affects the layers of the true skin, a cicatrix is always produced in the process of healing. In even cuts made by a very sharp instrument, especially if they be in the direction of the fibres of subjacent muscles, and the parts be kept in close apposition, the cicatrices are even, linear, and sometimes so small as to be scarcely perceptible. If, besides, the skin be white, they may be easily overlooked. Wounds of this kind are not, however, commonly the subject of a medico-legal inquiry. If, then, on examining a part, where at some previous time a stab or a cut is alleged to have been received, we find no mark or cicatrix, it is fair to assume that the allegation is false, and that no wound has been inflicted, making due allowance for the fact that mere abrasions of the cuticle, or very slight punctures and incisions, often heal without leaving any well marked cicatrices.

Is a cicatrix, when once formed, ever removed, or so altered by time as to be no longer recognisable?—This is rather an important question, which sometimes presents itself to a medical jurist both in civil and criminal proceedings. They who have given close attention to this subject agree in considering that cicatrices, when they are once so produced in the cutis as to be easily perceptible, are indelible:—they undergo no sensible alteration in their form or other external characters. The tissue of which a cicatrix is formed is different from that of the skin; it is harder and less vascular, and is destitute of rete mucosum, so that its whiteness, which is particularly remarkable on the cicatrized skin of a negro, is retained through life. If any cicatrices were easily obliterated, it would be those which are even and regular,—the results of incised wounds by sharp instruments; but from my own observation, I can undertake to say that cicatrices of this kind have certainly retained their characters unchanged in one instance for twenty, and in another for twenty-five years. According to the observations of Dupuytren and Delpech, the substance of a cicatrix is not converted into true skin—it never acquires a rete mucosum. In the cicatrices of lacerated and contused wounds, the form of the weapon with which the wound was inflicted is sometimes indicated. It is not, however, easy to distinguish the cicatrix of a stab from that produced by a pistol-bullet fired from a distance. In both cases the edges may be rounded and irregular, unless the stab has been produced by a broad-bladed weapon.

Characters of cicatrices.—It is important to observe that all cicatrices are of smaller size than the original wound; for there is a contraction of the skin during the process of healing. This is especially observed with regard to the cicatrix of a stab. The recent wound, as it has been elsewhere stated, is apparently smaller than the weapon; and the resulting cicatrix is always smaller than the wound. Hence it is difficult to judge of the size of the weapon from an examination of the cicatrix. In gun-shot wounds, if the projectile has been fired from a distance, the cicatrix is of less diameter than the ball:—it represents a disk depressed in the centre, and attached to the parts beneath; while the skin is in a state of tension from the centre to the circumference. If the bullet has been fired near the body, the cicatrix is large, deep, and very irregular. If the pro-

jectile has made two apertures, the aperture of exit is known by the greater size and irregularity of the cicatrix.

When was the wound inflicted?—When an individual is not seen until after death, and there are recent wounds on his body, a medical jurist may be required to state at what period they were probably inflicted. It may be taken as a general rule that there are no appreciable changes in any wound until eight, ten, or twelve hours have elapsed from the time of its infliction; then we have the various phenomena of inflammation, followed by adhesion, suppuration, or gangrene, during any of which stages the wounded person may die. Some remarks have already been made on the time at which adhesion and suppuration become established in wounds; and with respect to gangrene it may be observed, that the deceased must have survived at least fifty hours, in order that this process should be set up:—in old persons it may take place earlier.

In examining a dead body, we must take care not to confound the effects of putrefaction in a wound with those of gangrene. Putrefaction always commences sooner in parts which are wounded than those which are uninjured; but the general appearance of the body will show whether the changes in the wound are or are not due to putrefaction. The collapse of the eye will indicate the existence of this process; but the presence of warmth or rigidity of the members will show that death may have been too recent for putrefaction to have become established. The time at which a severe *contusion* has been produced may be commonly determined by noting the changes of colour which take place around it. It is rarely until after the lapse of twenty-four or thirty-six hours that these changes of colour appear. (See Ecchymosis, ante, p. 177.) The livid circumference passes into a green circle, which is gradually diffused into a wide straw-yellow band, bounding the ecchymosis on every side, if it be in a free or loose part of the skin. In four, five, or six days, the dark livid colour slowly disappears from the circumference to the centre, while the coloured bands spread more widely around. A central dark spot may be perceived after ten days or a fortnight, and in a very extensive ecchymosis it is some weeks before all traces of it are lost. The rapidity of these changes will be modified by circumstances elsewhere stated. Observations of this kind often lead to useful results when proper caution has been taken. The appearances presented by a contusion inflicted recently before death, and of another inflicted some days before, are of course different; and by an appreciation of this difference, a person charged with murder may or may not be connected with one or the other period of infliction, or with both. In a case of alleged manslaughter, in which I was consulted some years since, there were found on the person of the deceased, the wife of a mechanic, the marks of severe bruises; some of them, in the immediate neighbourhood of each other, had the rings of colour peculiar to a disappearing ecchymosis, while others had not. The man alleged in his defence that he had only struck his wife once, a few hours before her death, whereas the above medical facts proved not only that the deceased had been struck more than once, but that some of the blows must have been inflicted probably several days before her death. These inferences were corroborated by the evidence of an apprentice who had witnessed the assaults.

Such is an outline of the facts which may occasionally enable us to say how long before death particular injuries have been received; or to assign a probable period for their infliction on the living. By their aid we may have it in our power to determine whether two wounds found on a dead body were or were not inflicted at or about the same time. The law in these cases seldom requires a very precise medical opinion; indeed, it would be scarcely possible to give this under any circumstances. If a medical witness can only state *about* what time the injury was inflicted, circumstantial evidence will make up for the want of great medical precision or accuracy on the point.

How long did the deceased survive?—This question, it will be perceived, is indirectly connected with the preceding, although sometimes put with an en-

tirely different object. Supposing the wound not to have been such as to prove rapidly fatal, the length of time which a person has survived its infliction may be determined by noting whether it has undergone any changes towards healing, and in what degree. As a wound remains in the same state for about eight or ten hours after its production, it is not possible to say within this period how long the person may have survived. Then it has been supposed that a medical opinion might be formed from the nature of the injury, and the parts which it has involved. Thus, a wound may have involved large blood-vessels, or organs important to life: in this case it is pretty certain that the individual must have died speedily. Let us, however, bear in mind that these so-pronounced rapidly mortal wounds do not often prove fatal for some hours or days—a fact which has been much overlooked by surgeons, although of considerable importance in relation to the medical jurisprudence of wounds.

CHAPTER XXXII.

ACTS INDICATIVE OF VOLITION AND LOCOMOTION—INJURIES TO THE HEAD NOT IMMEDIATELY FATAL—WOUNDS OF THE HEART NOT IMMEDIATELY FATAL—WOUNDS OF THE CAROTID ARTERIES—LOCOMOTION AFTER RUPTURES OF THE DIAPHRAGM AND BLADDER—SUMMARY.

Acts indicative of volition and locomotion—In cases of death from wounds criminally inflicted, it is often a matter of serious inquiry, whether a person could have performed certain actions, or have moved after receiving an injury which is commonly regarded as necessarily mortal, and likely to destroy life speedily. In respect to wounds of a less grave description, if we except those affecting the members directly, which will be hereafter examined, the power of willing and moving in the person who has received them cannot be disputed. The best way of treating this subject will be, perhaps, to select a few cases of severe injuries to important parts or organs, which are usually considered to destroy life speedily. The question relative to the power of exercising volition and locomotion has been chiefly confined to those cases in which there were injuries to the head, wounds of the heart, the large blood-vessels, the diaphragm, and bladder.

Injuries to the head not immediately fatal.—The following case occurred a few years since in the Norfolk and Norwich Hospital:—A boy, owing to the bursting of a gun, had the breech-pin lodged in his forehead. He got out of a cart, in which he had been brought four or five miles, and walked into the hospital without assistance. The pin was firmly impacted in the frontal bone about the situation of the longitudinal sinus. On its removal, a portion of brain came away, with several pieces of bone, and the aperture in the cranium was nearly an inch in diameter. Symptoms of coma then came on, and the boy died in forty-eight hours. The brain was found to be considerably injured. (Med. Gaz. xviii. 458.) Mr. Watson mentions a similar case. During a quarrel between father and son, the latter threw a poker at the former with such violence that the head of the poker stuck fast in his forehead, and was with some difficulty withdrawn. The father asked those who were near him to withdraw the weapon, and he was afterwards able to walk to the infirmary. He died from inflammation of the brain. (On Homicide, 62.) A case occurred to Dr. Wallace, of Dublin, in which a man fell from a scaffold on the summit of his head. He was stunned by the fall, but on reaching the hospital, dismounted from the car which conveyed him, and walked up stairs with very little assistance. He died in three

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days, but he remained perfectly rational, and was enabled to get up and go to the water-closet the day before his death. On inspection, there was only a slight abrasion on the vertex, but the skull was found split into two nearly equal halves from the frontal bone backwards, through the sagittal suture to the foramen magnum. The longitudinal sinus was laid open throughout. In both hemispheres there was a large quantity of effused blood in a semi-coagulated state; and more than two ounces were found at the base of the skull. (Lancet, April, 1836.) Supposing this person to have been found dead with such extensive injuries, the medical opinion would probably have been that he was not likely to have lived or moved afterwards; and yet the power of volition and locomotion remained with him for two entire days!

It is easy to conceive many cases in which a question of this kind will be of material importance. For instance, a man may fall from a height, and produce a severe compound fracture of the skull. He may, nevertheless, be able to rise and walk some distance before he falls dead. Under these circumstances there might be a strong disposition to assert that the deceased must have been murdered:—the injuries being such that they could not have been produced by himself, there being at the same time no weapon near, and no height from which it might be supposed that he had fallen.

[According to Dr. F. D. Lente, in his statistics of fractures of the skull during twelve years in the New York Hospital (New York Journ. Med., Jan. 1852, and Am. Journ. Med. Sci. April, 1852, 578,) in not one of 106 fatal cases "did death follow the receipt of the injury, until after the lapse of some hours, even in the most desperate cases; nor does it appear to be possible for an ordinary blow upon the head, producing fracture of the skull, to cause immediate death." He subsequently reminds us that, in a recent criminal trial of great interest, "it was much discussed whether a blow upon the head with an ordinary weapon capable of inflicting death could produce this result instantaneously. Many eminent surgeons were examined, and the general impression was that the thing was exceedingly improbable, if not impossible, and the question was thus decided." Prof. F. H. Hamilton, of Buffalo, is stated by Dr. Beck to have arrived at a similar result in his account of thirty-three cases of fractured cranium, twelve of which were fatal. (Am. Journ. Med. Sci. Jan. 1853, 254.) See also Am. Journ. Med. Sci. April, 1852, 579, for two remarkable cases of long survival after injury of the head. We might add many others, some of which occurred under our eyes at the Pennsylvania Hospital, Philadelphia. Still, rare as immediate death must certainly be in consequence of wounds or other injuries by violence upon the head, we are not disposed to admit their impossibility as by any means established, although we are unable to recall a single instance in contradiction to the negative assertion.—H.]

Wounds of the heart not immediately fatal.—Wounds of the heart were formerly considered to be immediately fatal to life, but this only applies to those wounds by which the cavities of the organ are extensively laid open. Persons who have sustained wounds of the heart have frequently lived sufficiently long to exercise the powers of volition and locomotion. Mr. Watson met with a case where a man who had been stabbed in the right ventricle ran eighteen yards after having received the wound. He then fell, but was not again able to rise; he died in six hours. On dissection, it was found that a punctured wound had extended into the right ventricle in an obliquely transverse direction, dividing in its course the coronary artery. The pericardium was nearly filled with blood, and about four pounds were extravasated on the left side of the thorax. (On Homicide, 98.) One of the most remarkable instances of the preservation of volition and locomotion after a severe wound of the heart will be found reported in the Medical Gazette (xiv. 344.) In this case the patient, a boy, survived five weeks, and employed himself during that period in various occupations. After death a mass of wood was found lodged in the substance of the heart. Had this

boy been found dead with such an injury it is most probable the opinion would have been that his death was instantaneous.

[Cases in which persons have taken a few steps after fatal wounds of the heart or large vessels, are not very rare.—Beck (Med. Jurispr. ii. 329—332,) cites numerous examples, and among others, that of Dr. Randall, noted in the last Am. ed. of this work, in which the patient, a negro boy, lived sixty-seven days, and at one time walked about, after being shot in the chest with a fowling piece, and was then found to have received three shot in the right ventricle and two in the right auricle.—H.]

In these cases, little or no blood probably escapes from the heart in the first instance, but it may afterwards continue to ooze gently, or suddenly burst out in fatal quantity. It must not, therefore, be supposed, when a person is found dead with a wound of the heart, attended with abundant hemorrhage, either that the flow of blood took place in an instant, or that the person died immediately and was utterly incapable of exercising any voluntary power. Only one circumstance will justify a supposition of this kind—namely, where the cavities of the organ, more especially the auricles, are largely laid open.

Wounds of the carotid arteries not immediately fatal.—Questions relative to the power of locomotion perhaps more frequently occur with respect to wounds of the great blood-vessels of the neck than of the heart,—suicide and murder being more commonly perpetrated by this means. There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent the individual from running for a certain distance.

There is, however, one circumstance which requires notice in relation to severe wounds in the *throat*—namely, that although the individual may have the power of locomotion, he may not be able to use his voice so as to call for assistance. It sometimes excites surprise at an inquest, how a murder may in this way be committed without persons in an adjoining room hearing any noise;—but the fact is well known medically, that when the trachea is divided, as it generally is on these occasions, the voice is lost.

Locomotion after ruptures of the diaphragm.—A rupture of the *diaphragm* has been considered sufficient to deprive a person of the power of locomotion:—but there appears to be no good ground for this opinion. The general effect of such an injury may be to incapacitate a person; but the question is put to a medical jurist as to the possibility of a wounded party being able to move or walk after the injury,—and this, as a general rule, must be admitted.

Locomotion after ruptures of the bladder.—In ruptures of the *bladder*, attended with extravasation of urine, the same question as to the existence of a power of locomotion has arisen. By the answer to this we may sometimes determine whether the rupture was the result of homicide or accident. The following cases will show that this power does exist in some instances, although the general result is perhaps to incapacitate the individual from moving:—A man, aged thirty-one, while intoxicated, received a blow on the lower part of his abdomen. He was sobered by the accident, and walked home, a distance of a quarter of a mile, although suffering the greatest agony. When seen in the evening, twelve ounces of bloody urine were drawn off by the catheter, and he complained of having felt cold immediately after he had received the blow. He died four days after the accident. On inspection, there was no mark of bruise or ecchymosis on any part of the abdomen. The bladder was ruptured in its upper and posterior portion for about an inch. (Lancet, May 14, 1842.) The second case was related to me by a pupil. A gentleman who had been compelled to retain his urine fell accidentally in descending a staircase, with the lower part of his abdomen against the edge of one of the steps. The sense of fulness in his bladder immediately ceased, and he walked to a friend's house to dinner. The nature of the accident was mentioned to a surgeon there present, who immediately suspected that the

bladder must have been ruptured. The case terminated fatally in twenty-four hours. A case is reported by Mr. Hird, in which a man walked the distance of two miles after having sustained a rupture of the bladder; and in another which occurred in January, 1852, communicated to me by Mr. Rake of Newark, the man who sustained the injury in a scuffle was able to walk a mile between two and three hours after the occurrence. (Lancet, Oct. 31, 1846, 480.) Thus, then, from these various instances, it is evident that locomotion and muscular exertion may take place after an accident of this description.

Summary.—Under survivance from many severe accidents or personal injuries, this power of moving, if not exerted to a large extent, may take place in a small degree, and this may become occasionally an important question in legal medicine. Thus it must not be lost sight of, when we are drawing inferences as to the relative position of a murderer and a murdered person from the situation in which the body of the deceased is found. A dead man, with a mortal injury to the head or heart, may be found lying on his face, when he actually fell upon his back, but still had had sufficient power to turn over before death; or he may have fallen on his face, and have afterwards moved, so that the body may be lying on the back. A slight motion of this kind is very easily executed,—it does not always depend on volition. Individuals suffering under severe concussion have been frequently known to perform acts unconsciously and automatically.

The cases related may perhaps be considered rare, and as exceptions to the general rule. The medical jurist must bear in mind, however, that he is not required to state in how many, out of a given number of individuals similarly wounded, this power of performing acts indicative of volition and locomotion may remain, but simply whether the performance of these acts be or be not *possible.* It is on this point only that the law requires information. The hypothesis of guilt, when we are compelled to judge from circumstances in an unknown case, can only be received by the exclusion of every other possible explanation of the facts. As a matter of surgical prognosis or treatment, such cases, from their rare occurrence, may have little influence; but in legal medicine the question is widely different. Medical facts, however rare, here admit of a very important and unexpected application.

Although, in cases of severe wounds, we may allow it to be possible that persons should survive for a sufficiently long period to perform ordinary acts of volition and locomotion, yet the presence of a mortal wound, especially when of a nature to be accompanied by great hemorrhage, must prevent all *struggling* or violent exertion on the part of the wounded person,—such exertion we must consider to be quite incompatible with the condition of the wounded person. In this way a medical jurist may occasionally be able to determine whether a mortal wound found on the deceased has been inflicted for the purpose of murder or in self-defence, as the following case, reported by Mr. Watson, will show:—A man was tried at the Lancaster Assizes in 1834, for the murder of a woman at Liverpool, by stabbing her in the chest. Prisoner and the deceased, with two other females, were quarrelling in the passage of a house. A struggle ensued between the prisoner and deceased, which one of the witnesses said lasted for *ten minutes.* When the prisoner had reached the door, he pulled out a knife and stabbed the deceased in the chest. She fell, and died almost immediately. The prisoner alleged that he was attacked by several persons, and that he stabbed the woman in self-defence. The judge said, if the blow had been struck with premeditation before the struggle, the crime would be murder;—if during the struggle, it would be manslaughter. The medical evidence showed that the blow could not have been struck before the struggle, because it was of a speedily mortal nature; and the deceased would not then have been able, as it was deposed to by the witness, to struggle and exert her strength with the prisoner for *ten minutes* afterwards. This being the case, it followed that in all medical probability the deceased had received the blow towards the conclusion of the quarrel; and therefore it might

have been inflicted while the prisoner was attempting to defend himself. The jury returned a verdict of manslaughter.

Struggling under fatal wounds.—A case involving this important medico-legal question was tried at the Gloucester Lent Assizes, 1849 (*Reg.* v. *Hobbs.*) The prisoner was indicted for the wilful murder of a man with whom he had been drinking and quarrelling. It appears that in the early part of the quarrel the deceased threw the prisoner down and struck him unfairly. The deceased was told by the landlord of the inn to go home. He replied, "Very well," and then leaving the prisoner went through the entrance arch of the inn up the yard, which was his usual way of going home. About *seven minutes* afterwards, the prisoner, who had complained to the landlord of the maltreatment which he had undergone, returned into the inn-yard, and was seen on entering it to pull down his waistcoat and button his coat. A witness advised him to go home, and he left the spot. A short time afterwards the deceased was found at the back of the yard, lying on his face, and quite dead. On examining the body it was found that the deceased had been stabbed in two places, one of the stabs having penetrated the ventricle of the heart. On apprehending the prisoner, a large clasp knife was found in his pocket stained with blood. The prisoner admitted that he had stabbed the deceased, but said it was during the quarrel, and that he used the knife in self-defence while they had him on the ground. This was the defence. For the prosecution it was argued that the deceased had been stabbed by the prisoner subsequently to the quarrel—that he had gone through the gate into the yard to meet the deceased, had there stabbed him, and had caused his instant death. The medical witness who was called stated at first, that from such a wound death must have been instantaneous. In cross-examination, however, he admitted that the deceased might have lived some time after he had been stabbed, and on this evidence the prisoner was convicted of manslaughter, and sentenced to six months' imprisonment.

The medical facts of this case are rather imperfectly reported: hence it is difficult to give a decided opinion respecting the time at which the deceased was stabbed in the heart. It is true that the Duke de Berry survived a punctured wound of one of the ventricles for the long period of eight hours: but every case must be judged by the special circumstances accompanying it. The size of the stab in the ventricle is not stated; nor is it in evidence whether any blood was found on the spot where the deceased was struggling with the prisoner. That the deceased should have struggled with the prisoner for one minute after being stabbed in the ventricle of the heart, is contrary to all medical probability. It is also irreconcilable with the existence of such a wound, that the deceased should have spoken to the landlord—that he should not have called the attention of the latter to the fact of his having been stabbed by the prisoner while struggling with him,—that he should have been stabbed in the heart without knowing it, or without being aware of his condition,—that he should have been able thereafter to walk away through the inn-yard to the house, and survive seven minutes while thus walking; and yet all these circumstances must have happened, in order that the defence, and the verdict based upon it, should be true. Taking the facts as reported, it is, it appears to me, impossible to arrive at any other conclusion than that the deceased was stabbed by the prisoner subsequently to the quarrel, while he was walking through the inn-yard. The only circumstances for the defence were the prisoner's statement, and that, in some rare cases, wounds of the heart do not prove immediately fatal.

CHAPTER XXXIII.

WOUNDS AS THEY AFFECT DIFFERENT PARTS OF THE BODY—WOUNDS OF THE HEAD—OF THE SCALP—CONCUSSION—HOW DISTINGUISHED FROM INTOXICATION—EXTRAVASATION OF BLOOD—SEAT OF—AS A RESULT OF VIOLENCE, DISEASE, OR MENTAL EXCITEMENT—WOUNDS OF THE FACE—OF THE ORBIT—OF THE NOSE—DEFORMITY AS A CONSEQUENCE OF WOUNDS OF THE FACE—INJURIES TO THE SPINE—FRACTURES OF THE VERTEBRÆ—DEATH FROM INJURIES TO THE SPINAL MARROW.

THE *danger* of wounds, and their *influence in causing death*, are the two principal points to which the attention of a medical jurist must be directed.

WOUNDS OF THE HEAD.

Incised wounds affecting the scalp rarely produce any serious effects; but this will, of course, depend on their extent. When the wound is contused, and accompanied by much laceration of the integuments, it is highly dangerous, in consequence of the tendency which the inflammatory process has to assume an erysipelatous character. The results of these wounds are, however, often such as to set all general rules of prognosis at defiance. Slight punctured wounds will sometimes terminate fatally in consequence of inflammation being set up in the tendon of the occipito-frontalis, followed by extensive suppuration beneath; while, on the other hand, a man will recover from a lacerated wound by which the greater part of the integuments may have been stripped from the bone. There are two sources of danger in *wounds of the scalp:* 1. The access of erysipelatous inflammation. 2. Inflammation of the occipito-frontalis tendon, followed or not by the process of suppuration. Either of these secondary effects may operate fatally in slight or severe wounds. Neither can be regarded in the light of an unusual consequence of a severe wound of the scalp; but when one or other follows a very slight injury, there is reason to suspect that the patient may have been constitutionally predisposed; and if fatal effects follow, the influence of the predisposition might be considered as a mitigatory circumstance. Bad treatment may likewise lead to a fatal result from a wound not regarded as serious in the first instance; but the question,—how far the responsibility of the aggressor would be affected by a circumstance of this nature has been considered in another place, (ante, p. 229.) Wounds of the head are dangerous in proportion as they affect the brain; and it is rare that a severe contused wound is unaccompanied by some injury to this organ. There is, however, a difficulty with which the practitioner has here to contend—namely, that it is scarcely possible to predict, from the *external* appearance of the wound, the degree of mischief which has been produced internally. These injuries, as it is well known, are very capricious in their after-effects; the slightest contusions may be attended with fatal consequences, while fractures, accompanied by great depression of bone, and an absolute loss of substance of the brain, are sometimes followed by perfect recovery. (Cormack's Jour., Sept. 1845, 653; Med. Gaz. xxxix. 40; and Phil. Med. Exam. Nov. 1845, 696.) Another difficulty in the way of forming a correct prognosis consists in the fact, that an individual may recover from the first effects of an injury, but after a short time he will suddenly die; and on examination of the body, the greater part of the brain will be found destroyed by the suppurative process, although no symptoms of mischief may have manifested themselves until within a few hours of death.

Concussion.—The common effect of a violent contusion on the head is to produce concussion or extravasation of blood, or both. In concussion, the symptoms come on at once, and the patient, if severely affected, sometimes dies without any tendency to reaction manifesting itself. But the period at which death takes

place is liable to vary: a man may die on the spot, or he may linger in a state of insensibility several days, and in either case after death, no particular morbid change may be discovered; there may be simply abrasion. In the case of *Reg. v. Burgess*, (Liverpool Lent Assizes, 1845,) the deceased fell and died on the spot, and there was no lesion externally or internally. The state of insensibility observed in concussion is sometimes only apparent. Mr. Guthrie relates the following singular case:—A gentleman who had met with an accident on board of a vessel at sea, while lying apparently deprived of sense and motion, heard a discussion between a relative and another person, who supposed he was dying, as to how they should dispose of his body, and he was conscious of his utter inability to make any movement indicating that he was alive and understood their conversation. Fortunately they resolved to convey him to the port to which the vessel was bound.

Inflammation may follow the primary shock from concussion—suppuration will take place, and the patient may die after the lapse of some weeks, or even months. It is important, in a medico-legal point of view, to notice that an individual may move about and occupy himself, while apparently convalescent, for a week or ten days after recovery from the first shock, and then suddenly be seized with fatal symptoms and die. This apparent recovery leads to the common supposition, that death must have been produced by some intervening cause, and not by violence to the head,—a point generally urged in the defence of such cases. When the inflammation that follows concussion is of a chronic character, the person may suffer from pain in the head and vomiting, and die after the lapse of weeks, months, or even years. A case is mentioned by Hoffbauer, where the person died from the effects of concussion of the brain, as the result of an injury received eleven years before. (Ueber die Kopfverletzungen, 1842, 57.) Concussion may sometimes take place as a consequence of a violent fall on the feet, in which case the head receives a shock through the medium of the spinal column. The skull may be extensively fractured, and the brain may be even shattered by such a fall. This was the cause of death in the Duke of Orleans. (Med. Gaz. xxxvi. p. 368.)

Concussion distinguished from intoxication.—The symptoms under which a wounded person is labouring may be sometimes attributed to *intoxication*, and a medical witness may be asked what difference exists between this state and that of concussion. The history of the case will, in general, suffice to establish a distinction, but this cannot always be obtained. It is commonly said that the odour of the breath will detect intoxication; but it is obvious that a man may meet with concussion after having drunk liquor insufficient to cause intoxication, or concussion might take place while he is intoxicated,—a combination which frequently occurs. Under such circumstances we must wait for time to develope the real nature of the case; but concussion may be so slight, as sometimes closely to resemble intoxication; and in the absence of all marks of violence to the head and the existence of a spirituous odour in the breath, the medical examiner might be easily deceived. If there be no perceptible odour in the breath, the presumption is that the symptoms are not due to intoxication. On the other hand, intoxication may be so great as to give rise to the apprehension of fatal consequences, and the co-existence of a mark of violence on the head might lead to error in the formation of an opinion. What is the line of conduct to be pursued on such occasions? The examiner should weigh all the circumstances, and if there be one cause for the symptoms more probable than another, he should adopt it:—if there be any doubt, this should be stated to the court.

It is to be feared that medical witnesses are not sufficiently careful on these occasions, in determining whether there be any signs of intoxication about the injured person. Subsequent proceedings may render this a most important part of the inquiry. In November, 1851, the house-surgeon of a London hospital was severely reprimanded by a magistrate, in consequence of an omission to in-

quire and satisfy himself whether, in addition to the results of violence, a policeman who was brought to the hospital was or was not intoxicated when admitted. The fact was of importance in this way: the injuries to the head might have arisen from a fall, and a drunken man might readily meet with such injuries from accident. A person was charged with an assault on the policeman, but upon very suspicious evidence; and in fact, could intoxication have been proved or rendered probable, there would have been no ground for the charge. The medical man had already certified that the patient was not intoxicated, but when pressed in cross-examination could not say whether he was or was not. The case was immediately dismissed. There can be no excuse for not making an inquiry into the precise condition of an injured person, and arriving at the best judgment of which the case admits.

A state of intoxication often renders it difficult to form an accurate diagnosis in cases of alleged criminal wounding. Some instructive cases in reference to this complication of wounds have been published by M. Tardieu. (See Med. Gaz. xliv. p. 347.) [The question of intoxication is too often lost sight of at the proper time by the surgical attendant, in its relations with the cause of the injury.—In a case that was tried in Philadelphia not long since, a worthless plaintiff succeeded in recovering heavy damages of a rail-road company, on account of injuries from an accident which there is strong reason to believe was due to his intoxication. The company suffered, however, for want of sufficient evidence of this fact.—H.]

Extravasation of blood.—A blow on the head may destroy life by causing an extravasation of blood on the surface or in the substance of the brain. In pugilistic combats, when a person is thus struck, he commonly falls, and death may take place in a few minutes. On inspection, blood may be found effused either at the base or in the ventricles of the brain, and the question may arise—Did the injury which caused death arise from *a blow or a fall?* Two cases of this description are reported by Dr. Wharrie. The men were knocked down by blows with the fist, and they were taken up dead. (Cormack's Monthly Jour. Feb., 1846, 117.) It is not easy to give an answer to this question, nor is its relevancy in a legal view apparent, for as it was presumed the blow was the cause of the fall, it is fair to infer that the assailant should be responsible for the effects of either or both. A heavy blow on the head might cause fatal extravasation of blood; but in these instances the extravasation more commonly arises from the violent concussion which the injured person sustains by the fall. A medical witness will therefore in general be compelled to admit that the fatal effusion might have taken place either from the blow or the fall.

This subject has very important applications in legal medicine, for this is one of the most common causes of death in injuries to the head, and there are generally many cases of this description tried at the assizes. Extravasation may occur from violence, with or without fracture, and it may take place without there being any external marks of injury to the head. In the case of The *Queen* v. *Phelps* and others (Gloucester Aut. Ass., 1841,) it was proved that there was great effusion of blood, and even laceration of the brain, in the deceased, without any corresponding external injuries. See also, at the same assizes, the case of The *Queen* v. *Thomas*. The late Dr. Griffiths, the American editor of this work, mentions a case which was the subject of a trial at Massachusetts, in which an individual received a blow from a small stone, and died in ten minutes. On examination there was no external bruise or fracture of the bones: the ventricles were filled with coagulated blood, and all the vessels were gorged with blood. It is remarkable that the skull was in this instance unusually thin (p. 287, Am. ed.) The chief source of the effusion in violence to the head arises from a rupture of the meningeal artery, and this may occur from the mere shock or concussion, with or without a fracture of its bony canal. The blood thus effused acts by compressing the brain: this compression does not always cause death

unless the blood be in large quantity, or unless it be effused in or around the medulla oblongata. Thus the hemispheres will bear a degree of compression which, if it affected that portion of the base of the brain from which the spinal marrow proceeds, would instantly destroy life. The most fatal effusions, therefore, are those which take place in a fracture of the base of the skull, whereby one or both lateral sinuses are commonly ruptured.

In cases of injuries to the head proving fatal by *extravasation* of blood on the brain, an individual may recover from the first effects of the violence, and apparently be going on well, when he will suddenly become worse, and die. Extravasation takes place slowly at first,—it may be arrested by the effects of stupor from concussion, by a portion of the blood coagulating around the ruptured orifices of the vessels, or by some other mechanical impediment to its escape; but after a longer or shorter period, especially if the individual be excited or disturbed, the hemorrhage will recur and destroy life by producing compression. How many hours or days, after an accident, are required in order that such an increased effusion should take place, it is impossible to say; but in severe cases, fatal extravasation is observed to follow the injury within a very short time. Sir Astley Cooper relates the case of a gentleman who was thrown out of a chaise, and fell upon his head with such violence as to stun him in the first instance. After a short time he recovered his senses, and felt so much better, that he entered the chaise again, and was driven to his father's house by a companion. He attempted to pass off the accident as of a trivial nature, but he soon began to feel heavy and drowsy, so that he was obliged to go to bed. His symptoms became more alarming, and he died in about an hour, as it afterwards appeared, from extravasation of blood on the brain.

Extravasation from disease or violence. Diagnosis.—Blood may be found extravasated in various situations within the interior of the cranium; and the cause of the extravasation may be either disease or violence. The skill of a medical jurist is often required to determine which of these causes is the more probable, as where, for instance, a pugilist has died after having received severe injuries to the head, and his adversary is tried on a charge of manslaughter. On these occasions it is often urged in the defence, that the fatal hemorrhage might have arisen either from a diseased state of the vessels of the brain, or, if the evidence render it probable that the blow was the cause, that the effects of the blow were aggravated by a diseased state of the vessels, or by the excitement into which the deceased was thrown, either from the effects of intoxication or passion. When the brain is not lacerated by violence, the blood is effused either on the surface of the hemispheres,—between the membranes,—or at the base. It is not always seen under the spot where the blow was inflicted, but often by counter-stroke on the surface of the brain, directly opposite to it;—a case which a medical witness has frequently been required to explain on trials, and which depends on the same cause as fracture by counter-stroke, to be hereafter spoken of. (See case by Dr. Haworth, Med. Gaz. xxxvi. 368.) Effusions of blood from a diseased state of the vessels more commonly take place in the substance of the brain, but they sometimes occur on the surface of the organ from mere excitement or over-exertion of the muscular powers.

Extravasation from excitement.—When engaged in the investigation of a case of this kind, it is always a fair matter of inquiry whether the *violence*, upon the evidence, was not of itself sufficiently great to account for the extravasation of blood without the supposition of co-existing disease or excitement. Admitting that the rupture of a blood-vessel, and the extensive extravasation of blood on the brain, may take place from simple excitement and passion, yet this is an event comparatively rare, at least in the young and healthy, while nothing is more common than that these results should follow violent injuries to the head whatever the age or condition of the person. A medical witness should remember that on these occasions, if he is unable to say positively whether the extra-

vasation was due to the excitement or the blows, he will satisfy the Court if he only state clearly that which is, in his own mind, the more probable cause of death; and by weighing all the circumstances of the case exactly beforehand, he will rarely fail to find that one cause was more probable than the other. Thus, if a man, incited by passion and intoxication, is struck on the head, and the blow is very slight—such as an unaffected person would probably have sustained without injury—yet in this case insensibility and death follow, and, on examination, a quantity of blood is found extravasated in the substance of the brain, can it be a matter of doubt with the practitioner that the extravasation was chiefly due to the excitement under which the deceased was labouring? To take a converse instance: a man engaged in a personal conflict with another, is struck most violently on the head, or falls with great force on that part of the body; on inspection, it is found that death has arisen from extravasation of blood on the surface of the brain, and it would be no unexpected consequence of the violence inflicted that a similar appearance should be met with in an individual calm and unexcited,—Can the practitioner hesitate to say, under these circumstances, that the blow would satisfactorily account for the extravasation, without reference to any coexisting causes of excitement: these may be allowed to have their influence in giving an increased tendency to cerebral hemorrhage, or in aggravating the consequences of the blow, but no further.

WOUNDS OF THE FACE.

Wounds of the face are important on several accounts. When of any extent, they are usually followed by great deformity; and when they penetrate the cavities in which the organs of the senses are situated, they often prove fatal by involving the brain and its membranes, or by giving rise to inflammation in this organ. Wounds of the eye-brows are not always of so simple a nature as might at first sight be supposed. Besides being attended by deformity when they heal, they are liable to give rise, during the process of healing, to serious disorders of the neighbouring parts. Amaurosis and neuralgia are recorded among the secondary and not unusual consequences of such wounds, when the supra-orbitar nerve has become at all implicated. Under certain conditions of the system, there may be inflammation of the parts within the orbit, extending by contiguity to the membranes of the brain, and proving fatal by leading to the formation of matter within that organ. Amaurosis in the right eye has been known to occur from a contused wound, not of a very violent nature, to the right eye-brow. Dr. Wallace, of New York, has reported two cases of amaurosis following blows over the infra-orbitar nerve. (Med. Gaz. xxxi. 931.) Wounds apparently confined to the external parts of the face, frequently conceal deep-seated mischief. A sharp instrument penetrating the eyelid, and passing upwards with any force, will produce fracture of the orbitar plate of the frontal bone, which is known to be extremely thin, and even injure the brain beyond.

Wounds of the orbit.—Sir Astley Cooper relates, that a girl, while playing with a pair of scissors, accidentally fell, and the point of the scissors passed upwards under the upper eyelid. It was found difficult to extract them; the eye became inflamed, but for some days after the accident the child was in the habit of walking a considerable distance daily to receive medical advice. In about ten days she suffered violent pain, with symptoms of inflammation of the brain, under which she died. On inspecting the body, it was found that the orbitar plate of the frontal bone had been fractured, the dura mater torn, and the anterior lobe of the brain lacerated. (For a similar case, see Med. Gaz. xli. 553.) In several instances in this country, trials for murder have taken place, in which death has been caused by a penetrating wound of the orbit, leading to fracture of the orbitar plate and injuring the brain.

Wounds of the nose.—These wounds are, generally speaking, of a simple nature, rarely giving rise to serious symptoms, but they are almost always attended

with great deformity. If the injury be contused and, at the same time, extensive, a loss of the faculty of smelling will probably result. A penetrating wound of the nose, produced by passing a sharp-pointed instrument up the nostril, may destroy life by perforating the cribriform plate of the ethmoid bone and injuring the brain. Such a wound, it is obvious, might be produced without leaving any external marks of injury. Dr. Corkindale, of Glasgow, met with a case in which a man died in nine weeks from the effects of a wound of the nose, whereby the nasal bones were fractured. On inspection, there was copious inflammatory effusion at the surface of the brain, particularly at the part corresponding to the seat of the violence. An injury to the bones of the nose may prove fatal by giving rise to an attack of tetanus. A case of this kind has been elsewhere related.

Deformity as a consequence of wounds of the face.—Wounds of the face, when at all extensive, are always followed in healing by greater or less *deformity*. The medical witness may perhaps find these questions put to him in relation to them. Is the wound likely to be attended with deformity? Could such a wound of the face heal without deformity? or could the deformity, if it exist, have been produced by any other cause than the wound? These questions are of more importance than may at first sight appear. Thus a person may allege that he was severely wounded in the face, when the medical witness, on examination, may find no trace of such a wound as that described. Again, a person may seek damages from another in a civil action, by alleging that a particular deformity was produced by a wound, when the medical witness may be able to trace its origin to disease, or to some accidental cause.

INJURIES TO THE SPINE.

Injuries to the spine and spinal marrow seldom require medico-legal investigation; but this organ is liable to concussion from blows, to compression from fracture of the vertebræ, or the effusion of blood, with all the secondary consequences attending such accidents. Concussion of the spinal marrow commonly produces paralysis; but the symptoms may be of a still more alarming kind; and after death no traces of mechanical injury may be discovered. Blows on the spine unattended with fracture or dislocation, may, according to the observations of Sir B. Brodie, be followed by inflammation and softening of the spinal marrow. A slight injury has been known to cause death by giving rise to inflammation of the spinal marrow. (See Henke's Zeitschrift der S. A. 1840, ii. 407.) This organ is also liable to compression from very slight causes.

Fractures of the vertebræ.—These fractures are generally attended by displacement and compression of the spinal marrow. They are the more rapidly fatal, in proportion as the injury is high up in the vertebral column. The whole of the body becomes paralyzed below the seat of injury, by the compression of the spinal marrow. If the seat of compression be above the fourth cervical vertebra, death is commonly immediate: asphyxia results from paralysis of the phrenic nerves. In falls on the vertex from a height, it sometimes happens not only that the skull is extensively fractured, but that the dentiform process of the second vertebra is broken off, owing to the head being doubled under the body. This might really be the cause of death. From a case related by Mr. Phillips, it would appear that this accident is not always attended by fatal compression of the spinal marrow. (E. M. & S. J., Jan. 1838.) In a second case the individual survived fifteen months (ib. Oct. 1845, p. 527;) and in a third, where the fracture was caused by the patient turning in bed while his head was pressed on the pillow, death did not take place for *sixteen* months. (Copland, Dict. Pr. Med., Paralysis.) On several criminal trials, this injury has been proved to have been the cause of death; and in a memorable case, tried at Glasgow some years since (The *King against Reid*,) it became a material question, how far an injury of this kind might result from disease. It may happen that caries of the

bone or disease of the transverse ligament will cause a separation of the dentiform process from the second cervical vertebra. The state of the bone should, therefore, be closely examined. In Reid's case an acquittal took place, partly because the deceased had laboured under disease of the spine, and the exact state of the parts had not been noticed. Disease of the ligaments may also lead to a separation, followed by slow or rapid death, according to the degree of pressure.

Injuries to the spine and its contents are generally the result of falls or blows either on the head or the lower part of the column. The secondary consequences of these injuries are sometimes very insidious, so as to disarm suspicion, and death may take place quite unexpectedly some weeks after the accident. Spicula of bone separated by fractures may remain adherent for some time; and by a sudden turn of the head, be forced off and destroy life by penetrating the spinal marrow, at a long period after the infliction of the injury. This has been known to happen in fractures involving the margin of the foramen magnum, and in such cases death is immediate. The spinal marrow has been in some instances wounded in its upper part by sharp-pointed instruments introduced between the vertebræ. Death is an instantaneous result when the wound is above the third cervical vertebra:—there is no part of the spine where a weapon can so readily penetrate as this, especially if the neck be slightly bent forward. The external wound thus made may be very small, and if produced with any obliquity by drawing aside the integuments, it might be easily overlooked, or it might be set down as superficial. For a medico-legal account of a case in which death occurred from a stab in the back of the neck, causing a division of the spinal marrow, see Henke, Zeitschrift der S. A. 1839, H. ii. 1836.

CHAPTER XXXIV.

WOUNDS OF THE CHEST—OF THE LUNGS—RUPTURES FROM ACCIDENT—WOUNDS AND RUPTURES OF THE HEART—WOUNDS OF THE AORTA AND VENÆ CAVÆ—WOUNDS AND RUPTURES OF THE DIAPHRAGM—DIRECTION OF WOUNDS OF THE CHEST—WOUNDS OF THE ABDOMEN—DEATH FROM BLOWS ON THE CAVITY—RUPTURES OF THE LIVER, GALL-BLADDER, SPLEEN, KIDNEYS, INTESTINES, STOMACH, AND URINARY BLADDER—MEDICO-LEGAL QUESTIONS CONNECTED WITH RUPTURED BLADDER—WOUNDS OF THE GENITAL ORGANS—MUTILATION.

WOUNDS OF THE CHEST.

Wounds of the chest have been divided into those which are confined to the parietes, and those which penetrate the cavity. This division is important, so far as it relates to the prognosis of such injuries. Incised or punctured wounds of the parietes of the chest are rarely followed by dangerous consequences. The hemorrhage is not very considerable, and is generally arrested without much difficulty. They heal either by adhesion or suppuration, and unless their effects be aggravated by incidental circumstances, the prognosis is very favourable. Contusions or contused wounds of the thoracic parietes are, however, far more dangerous, and the danger is always in a ratio to the degree of violence used. Such injuries, when severe, are ordinarily accompanied by fractures of the ribs or sternum,—by a rupture of the viscera within the cavity, including the diaphragm,—by profuse hemorrhage,—or, as an after-effect, by inflammation of the organs, with or without suppuration. Fractures of the ribs are dangerous for several reasons: the bones may be splintered and driven inwards, thereby wounding the lungs and causing hemorrhage, or leading to inflammation of the pleura

or lungs. In fractures of the upper ribs, the prognosis is less favourable than in those of the lower, because commonly a much greater degree of violence is required to produce the fracture. A simple fracture of the sternum, without displacement of the bone, is rarely attended with danger, unless the concussion has at the same time produced mischief internally, which will be known by the symptoms. When, however, the bone is depressed as well as fractured, the viscera behind may be mortally injured. In a case of depressed fracture of the sternum, recorded by M. Sanson, the individual died after the lapse of thirteen days; and on inspection, it was found that the fractured portion of bone had produced a transverse wound of the heart about an inch in length. The cavities of the organ had not been penetrated, but the piece of bone was exactly adapted to the depression produced by it on the parietes. (Devergie, Méd. Lég. vol. ii. p. 243.) A witness will frequently be required to take into consideration the effects of contusions on the thorax, with or without fracture, in cases of death from pugilistic combats, which of late years have given rise to numerous trials on charges of manslaughter. Wounds penetrating into the cavity of the thorax are generally dangerous, even when slight, in consequence of the numerous accidents with which they are liable to be complicated. In these wounds, the lungs are most commonly injured; but, according to the direction of the weapon, —the heart, or the great vessels connected with it, as well as the œsophagus or thoracic duct, may share in the mischief.

Wounds of the lungs.—The immediate cause of danger from wounds of these organs is the consequent hemorrhage, which is profuse in proportion to the depth of the wound and the size of the vessels wounded. Should the weapon divide any of the trunks of the pulmonary veins, the individual may speedily sink. The degree of hemorrhage cannot be judged of by the quantity of blood which escapes from the wound; for it may go on internally, and collect within the cavity of the pleura, impeding the respiratory process. This is especially to be apprehended when the external orifice is small and oblique, and one of the intercostal arteries has been touched by the weapon. A wound of the lung is generally known, among other symptoms, by the frothiness and florid colour of the blood which issues from the orifice, as well as by the expectoration of blood. The lungs may sustain serious injury from a blow or fall, and yet there may be no external marks of violence or symptoms indicative of danger for some hours. A young man, while riding, fell from his horse on his left arm. He complained of no pain for five hours, but in twelve hours he was seized with an alarming flow of blood from the mouth. He died in the course of a few days. After death there was no mark of injury to the chest, but the right lung was ruptured posteriorly throughout its length, and much blood had become extravasated. (Lancet, November, 1842.) During the convalescence of an individual who has survived the first effects of a penetrating wound of the chest, the surgeon should observe whether death, when it occurs, may not have been caused by any imprudence on the part of a patient, or by abuse of regimen or other misconduct; for circumstances of this nature may be occasionally regarded as mitigatory on the trial of an aggressor. It is very properly recommended that, in all cases where a party is progressing to recovery, a relaxation of the antiphlogistic regimen should be made with great circumspection. Too much nourishment, too frequent talking, or any exertion, are circumstances that may cause a renewal of the hemorrhage and extravasation. A case is related, in which a soldier died instantly from internal hemorrhage, brought on by throwing a bowl at some nine-pins, two months after he had been apparently cured of a wound of the lungs.

Wounds of the heart.—Wounds of the heart are among the most fatal of penetrating wounds of the chest. It was formerly considered that all wounds of this organ were necessarily and instantly mortal. Undoubtedly, when either of the cavities is laid open to a large extent, the hemorrhage is so profuse, on the withdrawal of the weapon, that death must be immediate. But when the wound

is small and penetrates into the cavities of the organ obliquely, life may be prolonged for a considerable period; and cases are on record in which it is probable that such wounds would have healed, and the patients have finally recovered, but for the supervention of other diseases which destroyed life. Dupuytren has reported the case of a man who received a stab on the left side of the chest, on November 5th, 1831. He was brought to the Hôtel Dieu, but the symptoms under which he laboured did not lead to the suspicion that he had received a wound of the heart. The man died on the 13th, of cerebral disease. On inspection of his body, it was found that the left ventricle was wounded about the middle and a little to the right; its cavity having been penetrated in a transverse direction. The wound was three lines and a half across, and one line from above downwards. The external fibres of the organ were most separated; the opening diminished gradually, so that the internal fibres were in contact and closed the wound. A boy, in pulling a knife from a companion with the point towards him, accidentally stabbed himself in the chest. A small quantity of florid red blood escaped—he vomited and fell to the ground. He died in eight days. The left ventricle had been perforated, and one pound and a half of blood was effused in the chest. This case shows that the fatal hemorrhage is not always immediate. (Med. Gaz. ii. 721.) In another instance recorded by Baron Dupuytren, five or six wounds were made by means of a saddler's needle,—most of them penetrating into the right ventricle of the organ. This man died of cerebral disease, twenty-five days after the wounds could have been possibly inflicted; for the needle was taken from him twenty-five days before his death, without any suspicion being entertained of his having wounded himself with it. The external cicatrix was visible on an inspection of the body. The quantity of blood found in the chest amounted to about three ounces, and this appeared to have proceeded from the substance of the heart. (Med. Gaz. vol. xiii. p. 662.) For cases in illustration of the position that wounds of the heart are not instantaneously mortal, see Med. Gaz. ii. 721.

In the opinion of Baron Dupuytren, these injuries are not necessarily fatal, although I believe, with one exception, there is no case on record in which a person has recovered from a penetrating wound of the cavities of the heart. (Ed. M. and S. J., Oct. 1844, 557; also Ann. d'Hyg., 1846, i. 212.) There are few, probably, who will be inclined to consider them curable; a remote possibility of simple wounds healing, and of the patient recovering, may be admitted; but until some clear instances of recovery from penetrating wounds of the cavities are reported, the majority of practitioners will continue to look upon them as fatal. From a series of cases collected by MM. Ollivier and Sanson, it appears that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others, death took place at the varying periods of from four to twenty-eight days after the receipt of the wound. (Devergie, Méd. Lég. vol. ii. p. 246.) These differences in the time at which death occurs, as well as the fact that wounds of the heart do not instantly destroy life, have been ascribed to the peculiar disposition of the muscular fibres of the organ, and to the manner in which they are penetrated by a weapon. Thus, as a general principle, it is stated that wounds which are parallel to the axis of the heart are, cæteris paribus, less rapidly fatal than those which are transverse to its axis. In a wound which divides the fibres transversely, the opening will be larger, and the hemorrhage greater, than in one which is parallel to these fibres; and as the heart is composed of different layers, of which the fibres pass in different directions, so in a penetrating wound of its cavities, while one set tends to separate the edges, another tends to bring them together, and thereby to restrain the flow of blood. It is this action of the fibres which renders wounds of the ventricles less rapidly fatal than those of the auricles, all other circumstances being equal; but a man has been known to survive a laceration of the left auricle eleven hours. In the 17th vol. of the Medical Gazette, page 82, a

case is reported in which a person is stated to have recovered from a punctured wound of the heart; and Dr. Trugien met with a case in which a man who had been stabbed in the left ventricle survived *five* days. The wound in the heart had partly cicatrized. (See Med. Gaz. vol. xlvii. p. 42.) [For cases, see Beck, *loc. citat.*—H.]

Ruptures of the heart.—The heart is liable to be *ruptured* either from disease or accident. In the latter case, the organ generally gives way towards the basis, and through one of the cavities on the right side. (For cases, see Med.-Chir. Rev. xxxi. 532.) Dr. Hope asserts that in ruptures from natural causes, it is the left side of the heart, and particularly the left ventricle, in which the lesion is most frequently found. The symptoms are sudden pain, collapse, cramps, cold extremities, and rapid death. According to the circumstances under which they occur, cases of rupture from disease may excite a suspicion of death from violence. Sometimes the substance of the heart appears to have undergone a fatty degeneration. Dr. Quain met with a case in which, under this diseased condition, the left ventricle had become ruptured during slight muscular exertion. (Med. Gaz. xxxviii. 774 and 857.) In other instances there has been no apparent alteration of structure. Dr. Stroud reported to the Med.-Chir. Society a case of this kind, which occurred in a young man aged twenty-nine. The deceased died in ten hours after his first seizure: on inspection there was a small aperture in the right auricle near the vena cava. This did not appear to be connected with any morbid condition of the heart. (Med. Gaz. xxvi. 518; Lancet, Nov. 1843.) As a medico-legal subject, it is worthy of note that when this alarming accident proceeds from blows or falls, it is not always accompanied by marks of external violence,—or any fracture or other injury to the exterior of the chest.

It is proper to state, that the *natural* causes of rupture of the heart are violent mental emotions, such as anger, fright, terror, paroxysms of passion, sudden or excessive muscular efforts, or violent physical exertions in constrained positions. The heart, like any other muscle, may also give way from its own powerful contraction. The left auricle of the heart has been ruptured as a mere result of great physical exertion. (See case, Med. Gaz. vol. xlviii. p. 1063.) Rupture of the heart from any of these causes is, however, a very rare occurrence. (Med.-Chir. Rev., Oct. 1847, 460.)

Wounds of arteries and veins.—Wounds of the large arterial and venous trunks around the heart must be considered as decidedly mortal: death is generally instantaneous from the profuse hemorrhage which attends them. Dr. Heil, of Bamberg, has related a case which he considers to prove that a person may recover from a penetrating wound of the *ascending aorta*. (Henke's Zeitschrift, 1837, ii. 459.) With regard to these fatal extravasations of blood within the chest, as well as in the other great cavities, it may be proper to mention that, from whatever vessel or vessels the blood may have issued, it is not commonly found coagulated to any extent. The greater part of it generally preserves the liquid state; and it is rare that so much as one-half of the quantity effused is met with in the form of coagulum. These extravasations of blood in the chest may be sometimes traced to wounds of the intercostal, the internal mammary arteries, or of the vena azygos.

Wounds of the *carotid arteries* have been considered in speaking of wounds of the throat. Of wounds of the other blood-vessels, whether arteries or veins, it is unnecessary to make any further remark. Death is generally owing to hemorrhage, and the bleeding from a comparatively small vessel may prove fatal, according to its situation and the state of the individual. [See Am. Cyc. Med. and Surg., Art. Aorta, ii. 185.—H.]

Death from the entrance of air into wounded veins.—In the wounds of *veins*, there is a peculiar cause of death which requires notice, namely, the entrance of air by the open mouth of the divided vessel. Accidents of this kind are by no

means common. The following case occurred to Dr. Willis, of Barnes, in March, 1848:—A man was labouring under chronic laryngitis, and it was considered proper to introduce a seton at the fore part of the neck. The skin was raised, and the seton-needle was passed horizontally through the skin, about two inches and a half above the breast-bone, and not at all near the jugular vein or any other important blood-vessel. At the instant of its entrance, there was a momentary hissing sound,—the man became pale,—his features were set,—he fainted, and he subsequently became rigid and convulsed. The man did not recover his consciousness, was attacked with lock-jaw, and died in seven hours. From the medical evidence given at the inquest, it was obvious that death had not arisen from hemorrhage, but from the air penetrating through a small vein which had been accidentally divided. A verdict was returned accordingly. After the inquest, the body was inspected, and it was then found that the jugular veins and the large vessels of the neck were uninjured. The right auricle and pulmonary artery were distended with frothy blood, and the lungs were emphysematous. (Med. Gaz. xli. page 608.) For another case of sudden death from this cause, see Med. Gaz. xliii. 1098. See also a paper by Mr. Lane, vol. xlv. page 926.

It has been long known that air injected into the jugular vein would destroy life by interfering with the functions of the heart. The exact nature of the accident, as it occurs in operations, is not well understood. (Ferguson's Surgery, 444.) According to some, the air rushes into the cavity of the vessel owing to atmospheric pressure during the expansion of the heart, while others believe it to be dependent on the act of inspiration. It is difficult to account for the entrance of air by atmospheric pressure, unless the cut orifice of the vein be kept open, or unless its coats be morbidly thickened, so that it does not readily close when divided: nevertheless, death may thus occur without the slightest imputation on the operator. Dr. Cormack has shown that in some alleged cases of this kind, death was probably due to hemorrhage. When the hemorrhage is slight, and the hissing sound is heard at the time of the incision, it may fairly be ascribed to the entrance of air. This opinion would be confirmed by the discovery of a frothy state of the blood in the right cavities of the heart.

Wounds of the diaphragm.—This muscular septum is liable to be wounded either by weapons which penetrate the cavity of the thorax or abdomen, or by the ribs when fractured by violent blows or falls; but, under any circumstances, wounds of this muscle are not likely to occur without implicating the important organs that are in contact with it. It is scarcely possible, therefore, to estimate the danger of these injuries abstractedly, as the prognosis must materially depend on the concomitant mischief to the adjoining viscera. Slight penetrating wounds of the diaphragm may heal, like those of other muscular parts; and cases of this kind are on record. There is, however, especially when the wound is of a lacerated kind, a consecutive source of mischief which no remedial means can avert; namely, that after the wound has, to all appearance, healed, the life of a person may be cut short by the strangulation of a portion of the stomach or viscera in the half-cicatrized aperture. An instance reported by Dr. Smith affords an illustration of this. A sharp-pointed weapon had penetrated the diaphragm, notwithstanding which the patient apparently made a rapid and perfect recovery.—At the end of about three months, however, the man died from a strangulated hernia of the stomach, which had passed through the wound of the diaphragm into the thorax. (For. Med. p. 279.) In a case of this description, when death occurs at a very considerable period after the infliction of a wound, the witness will probably be asked,—Whether the wound was the cause of death? Or whether there were any other circumstances which would have caused or facilitated the production of a hernia? The degree of culpability of an aggressor may materially depend upon the answers returned to these questions. *Phrenic hernia*, as it is termed, is not by any means an unusual or unexpected fatal consequence of a wound of the diaphragm; and therefore it would appear, at first sight, that death, at

whatever period this event may occur, should be referred to the original wound. But the question is of a very delicate nature; as it is possible that a slight blow on the stomach, received subsequently to the wound, or even any violent exertion on the part of the deceased, might tend to produce strangulation. [According to Guthrie, wounds of the diaphragm never close; so that the liability to strangulation always persists after such injuries.—H.]

Ruptures of the diaphragm.—The most serious injuries to the diaphragm are unquestionably those which are produced by violent contusions, or falls on the abdomen, while the stomach and viscera are distended. In these cases the muscular fibres are commonly found ruptured to a greater or less extent: the hemorrhage is not very considerable, rarely exceeding two, three, or four ounces. A uniform result of these ruptures, when extensive, is a protrusion of the stomach into the chest, with sometimes a rupture of the coats of that organ and extravasation of its contents. Severe lacerations of the diaphragm are more readily produced during the act of inspiration, than during expiration,—the fibres of the muscle being then stretched, and receiving, while in this state of tension, the whole of the force. According to Devergie, the rupture most frequently takes place in the central tendinous structure, where it is united with the left muscular portion above the crura. He has remarked that it is observed more commonly on the left side than on the right. (Op. cit. ii. p. 250.) It has been supposed that death was an immediate consequence of this accident; but this view is not supported by facts. In the case of extensive rupture of the diaphragm above referred to, where the stomach and colon were found in the chest, the person lived nine months after the only accident which could have produced it, and then died from another cause. Besides the stomach, it sometimes happens that the liver, spleen, or intestines passes through the opening, and, like it, these organs are liable to become strangulated: the lungs are, at the same time, so compressed that respiration is stopped, and asphyxia is often an immediate result.

Direction of wounds in the chest.—In judging of the *direction* taken by wounds which traverse the antero-posterior axis of the chest, it is necessary to remember the great difference that exists in the level of the same rib anteriorly and posteriorly. This must be especially attended to, when we are called upon to state the direction of a traversing wound from the description of it given by another. The point here referred to had an important bearing in the case of a fatal gunshot wound which was the subject of a criminal charge some years since. (Henke's Zeitschrift, 1836.)

WOUNDS OF THE ABDOMEN.

Wounds of the Parietes.—*Incised and Punctured* wounds, which affect the parietes of the abdomen, without penetrating the cavity, are not quite of so simple a nature as might at first sight be imagined. The danger is immediate, if the epigastric artery be wounded; for a fatal hemorrhage will, in some instances, take place from a wound of this small vessel. *Contusions* are attended generally with far more serious effects on the cavity of the abdomen, than on the thorax. This arises from the abdominal parietes having less power to resist external shocks. In the first place, death may be the immediate result of a blow in the upper and central portion; no particular morbid changes will be apparent on inspection, and the violence may have been so slight, as not to have produced any ecchymosed mark on the skin. Death has been ascribed in these cases to a fatal shock transmitted to the system, through a violent impression produced on the solar plexus. In a case of manslaughter tried at the Cent. Crim. Court, in Aug., 1841 (*The Queen against Sayers,*) death had been caused in this way during a pugilistic combat. The man received a blow in the stomach, and fell dead. As there were no marks of external injury, the surgeon thought the man had died of apoplexy. The prisoner was acquitted. Blows on the abdomen, when they do not destroy life by shock, may cause death by inducing peritoneal inflamma-

tion. Among many instructive cases of this kind, is one recorded by Dr. Allen, in which fatal peritonitis followed a very slight amount of violence to the abdomen. (See Lancet, Jan 5, 1850, p. 29.)

Ruptures of the liver.—Violence to the abdomen may also prove fatal by causing a rupture of the viscera with extravasation of blood; and, as it has been elsewhere stated, these serious injuries may occur without being attended by any marks of external violence. Of all the internal organs, the liver and spleen are the most exposed to rupture, owing to their very compact structure, which prevents them from yielding to a shock, like the hollow viscera. Ruptures of the liver may occur from falls or blows; but this organ may be ruptured merely by a sudden action of the abdominal muscles. An accident of this kind happened to an individual who was endeavouring to avoid a fall from his horse. (Male's Jur. Med. 119.) A fall on the feet from an elevated spot may also determine laceration of this organ. (Ann. d'Hyg. 1846, i. 133.) Ruptures of the liver are generally seen on the convex surface, seldom extending through the whole substance of the organ, but consisting of fissures, varying from one to two inches in depth. Their usual direction is from before backwards, with a slight obliquity; they rarely intersect the liver transversely. The lacerated edges are not much separated, while the surfaces present a granular appearance. But little blood is met with in the laceration; it is commonly found extravasated in the lower part of the cavity of the peritoneum, or in the hollow of the pelvis, and is only in part coagulated. Ruptures of the liver, unless they run far backwards and involve the vena cava, are not in general attended with any considerable effusion of blood; but the hemorrhage, should this vessel be implicated, is sufficient to cause the instant destruction of life. Under other circumstances, a person may survive some hours. Rupture of this organ may take place from violence applied to the *chest*, and there may be no marks of injury over the region of the liver. (See case, Med. Times, Aug. 30, 1851, p. 234. For other cases, see Med. Gaz. xlvii. 156.) [Superficial wounds of the liver are much less fatal than the deep-seated, especially if these latter involve either of the portal vessels or the duct. In fact, wounds of the liver, *cæteris paribus*, do not appear to be as fatal as ruptures of this organ. For several cases where patients have survived serious wounds, see *North Amer. Arch.* i. 385, and *Amer. Med. Intell.* i. 191. *Amer. Cyclop. Med. and Surg.*—art., Wounds of the Abdomen.—H.]

Wounds of the gall-bladder.—Wounds and ruptures of the gall-bladder are necessarily attended with the extravasation of bile. This irritant fluid finds its way into the cavity of the peritoneum, and the individual dies from peritonitis. A fatal case of this description occurred to Dr. Maclachlan. An old man while getting out of bed fell with great violence on the floor. He died from peritonitis in forty-eight hours. The gall-bladder was ruptured, and a large calculus was found impacted in the cystic duct. (Med. Gaz. xxxvii. 968.)

Ruptures of the spleen.—Ruptures of the spleen may occur either from violence or disease, and it would appear from the following case, reported by Mr. Heddle, (Med. Chir. Rev., Oct. 1839,) that a very slight degree of violence is sufficient to rupture this organ, while there may be no marks of injury externally. A middle-aged man was observed fighting with a boy about fourteen years of age, who in stature scarcely reached to his waist. When the fight had terminated, the boy ran away: the deceased was observed to become very weak and faint, and he complained of uneasiness in his left side. He expired a few minutes afterwards. On inspection, no mark of violence could be detected; but the cavity of the abdomen contained a large quantity of blood. The spleen was found enlarged, and so softened that its structure was broken down by the slightest pressure. There was a laceration across its surface, about half an inch in depth, from which the fatal hemorrhage had proceeded. A case of spontaneous rupture of the spleen, which was enlarged and in a diseased condition, is reported in the Medical Gazette, (June, 1842.) It is highly probable that when the liver

and spleen are ruptured from slight causes, the structure of these organs will be found in a diseased condition—a circumstance which may in some cases be regarded as mitigatory of the act of the assailant. (See also Medical Gazette, xxxv. 942.)

Ruptures of the kidneys.—The *kidneys* are occasionally ruptured from violence; but this appears to be a rare accident. Two cases were reported by Mr. Stanley to the Med. Chir. Soc. (Lancet, Nov. 1843.) In one the individual recovered—in the other, death did not take place for a considerable time.

Ruptures and wounds of the intestines.—Ruptures of the intestines sometimes take place from disease, and in a case of rupture alleged to have been produced by violence, we must always take this possible objection into account. The ruptured part should be carefully examined, in order to see whether there be any signs of ulceration about. If not, and there be clear evidence of violence having been used, it is impossible to admit this speculative objection. If with the proof of violence there should also be a diseased condition of the bowel, we may be required to say whether this did not create a greater liability to rupture,—a point which must be admitted. (For interesting medico-legal cases of ruptured intestines, see Watson on Homicide, 159; also, Henke, Zeitschrift der S. A. 1836, Erg. xxii. and Brit. and For. Rev., iv. 519.)

Punctured wounds which merely touch the bowels without laying open the cavity, are liable to cause death by peritonitis. These injuries to the intestines sometimes destroy life by shock; there is but little blood effused, and the wounded person dies before peritonitis can be set up. Severe wounds to the intestines may, however, be inflicted almost without the consciousness of the individual, and the wounded person may be able to walk a considerable distance. (Med. Gaz. xlvi. page 24.)

Wounds and ruptures of the stomach.—Wounds and ruptures of the stomach may cause death by shock: ruptures commonly give rise to the most excruciating pain, which of itself is sufficient to bring about rapid dissolution. It is proper to state, however, that the stomach may become ruptured from spontaneous causes, as in ulceration produced by disease; but sometimes there is no morbid cause to explain the result. In April, 1828, a man, aged thirty-four, was brought into St. Bartholomew's Hospital, complaining of severe pain in the abdomen. Ten hours afterwards he was seized with violent vomiting; the pain ceased, the vomiting also ceased; and he died in five hours more. The posterior surface of the stomach was found lacerated to the extent of three inches, and the contents of the organ had escaped through the aperture; the mucous membrane was reddened, but there was no thickening, ulceration, or any apparent disease of the stomach. (Med. Gaz. ii. 182: see also Dub. Med. Jour., May, 1845; and Ed. Med. and Sur. Jour., Oct. 1845, p. 522.) Penetrating wounds of the stomach generally prove rapidly mortal; they seldom form a subject of medico-legal examination; but a singular case was tried at the Norwich Assizes in 1832, where a man was charged with the murder of his wife, by throwing at her a red-hot poker. The weapon completely perforated her stomach, and she died in six hours. It might be questioned whether this was a *wound* in the common sense of the term; it was an injury compounded of a burn, puncture, and laceration.

Ruptures of the bladder.—This injury, which has on several occasions of late years given rise to some medico-legal discussion, is frequently the result of blows on the lower part of the abdomen. The principal questions to be answered are: Was the rupture the result of wilful violence or of an accidental fall? or, Did it proceed from spontaneous causes, as from over-distention? The spot in which rupture commonly takes place is in the upper and posterior part, where the organ is covered by the peritoneum. The aperture is sometimes large, at others small; but the effect is, that the urine becomes extravasated, and death takes place through peritoneal inflammation. It is commonly stated that these ruptures, when attended with the extravasation of urine into the peritoneal cavity, are uni-

formly fatal. If the rupture occurs in the under part of the bladder, or the u finds its way into the cellular tissue, the prognosis is not so unfavourable. Syme has lately reported a case of recovery under these circumstances. (gical Contributions, 332.)

The usual period at which death occurs from this accident is in from th seven days, but Mr. Ellis met with a case where the person did not die the fifteenth day. There is another circumstance of medico-legal importa respect to these ruptures; namely, that when produced by a blow, they are accompanied by the slightest mark of ecchymosis, or of injury to the skin. then, there are no means of distinguishing, by an external examination, wh the rupture was really due to violence or to spontaneous causes. They wh unacquainted with this fact might be disposed to refer the rupture to on the supposition that violence would be indicated by the usual character ternally; but there are numerous cases on record which show that this vi erroneous.

As an attempt may be made, in cases in which death has resulted from injury, to refer rupture of the organ to natural causes, it may be observed this is a very unusual occurrence; a rupture is almost always the result of lence directly applied to the part, while the organ is in a *distended* state. *spontaneous rupture* may, however, occur,—1. When there is paralysis, w want of power to expel the urine; 2, when the bladder is ulcerated or othe diseased; 3, when there is an obstruction in the urethra from stricture or causes. These causes of spontaneous rupture are easily recognisable by ascertaining the previous condition of the deceased, or examining the bladder urethra after death. If a man were in good health prior to being struck,—i suddenly felt intense pain, could not pass his urine afterwards, and died from attack of peritonitis in five or six days; if after death, the bladder was found lacerated, but this organ and the urethra were otherwise in a healthy condi there can be no doubt that the blow was the sole cause of rupture and d In such a case, to attribute the rupture to spontaneous causes, would be equi denying all kind of causation. As to the absence of all marks of violence exte nally, this would only be a difficulty to those who had not previously made themselves acquainted with the facts attending this accident. Nevertheless, the medical witness must be prepared to hear the same line of defence continually urged: it is of course the object of a counsel to make the best of a case for the prisoner, and his duty consists in seeing him judged according to law, and condemned contrary to law. With medical facts, opinions, and doctrines he does not concern himself, so long as they do not serve his purpose.

Can the bladder be ruptured by an accidental fall, and if so, by what kind of fall?—The following case, reported by Mr. Syme, shows that this accident may readily occur. A woman, aged twenty-six, fell forwards over the edge of a tub, and fainted immediately. On recovering herself, she complained of the tense pain in the abdomen, with inability to pass the urine. Peritonitis soon on, and she died in a week. On inspection, a small aperture was found in the upper part of the bladder; the peritoneum was extensively inflamed from the urine which had become effused. The ruptured surfaces had become partly glued together. (Ed. Med. and Surg. Jour., Oct. 1836.) Rupture of the bladder may take place from an accidental fall, and cause death without necessarily laying open the peritoneal cavity. Two interesting cases of this kind have been reported by Mr. Wells. (Med. Gaz. xxxvi. p. 621.) The patients were sailors who fell from their hammocks while in a state of intoxication. The usual symptoms followed,—one died in five, and the other in eight days, from peritonitis; and after death it was clearly found, in one instance at least, that the bladder had been ruptured in the usual situation, but the peritoneum was entire, although in a state of intense inflammation. A more recent case of this kind, which was the subject of a trial (*Reg.* v. *Dixon*, Durham Lent Assizes, 1846,) has been

communicated to me by Mr. Steavenson. The prisoner kicked the deceased in the pubic region from behind. The man died from peritonitis in thirty-five hours. On inspection, the bladder was found ruptured near its neck for about half an inch, immediately above and to the left of the prostate gland. The urine had become extravasated into the cellular tissue of the scrotum: but although there was extensive inflammation, the peritoneum was not lacerated. On the other hand, a remarkable case is reported by Mr. Bower, in which a man died on the sixth day from rupture of the bladder; and after death, although the peritoneum was lacerated, and the cavity of the abdomen was filled with dark-coloured urine, there was no sign of peritoneal inflammation! (Lancet, Dec. 19, 1846, 660.)

This accident is liable to occur in females during parturition, owing to the pressure of the child's head, an occurrence which may fix a charge of malapraxis on the medical attendant. He is expected to know the probability of such an accident occurring, and to guard against it, if necessary, by the frequent use of the catheter. A surgeon was a few years since tried on a charge of this kind. (*Reg.* v. *Balsoner*, Liverpool Lent Assizes, 1838.) It is important to remember, that although rupture of the bladder is commonly attended at the time with intense pain, sickness, and prostration of strength, yet individuals may occasionally retain the power of exerting and moving themselves after the accident. In punctured and incised wounds of the bladder, the urine is immediately extravasated; but in gun-shot wounds, the extravasation does not commonly take place until the sloughs have separated. Thus, life may be protracted longer in cases of gun-shot, than under other wounds of the bladder. Barzellotti relates the case of a medical student, shot through the bladder in a duel, who did not die until the *twentieth day*, from the peritonitis which supervened on the extravasation. (Questioni di Med. Leg. t. iii. 174.) One instance of a person recovering from a gun-shot wound perforating the bladder is reported by Mr. Douglas in the Ed. Med. and Sur. Jour. vol. xiii.

For the discovery of extravasated liquids or blood, in wounds and other injuries to the abdominal viscera, we must look to the cavity of the pelvis, as it is here that, for obvious reasons, such liquids have a tendency to collect.

Wounds of the Genital Organs.—Wounds of these organs do not often require the attention of a medical jurist: such wounds, whether in the male or female, may, however, prove fatal to life by excessive hemorrhage. Self-castration or mutilation is not unfrequent among male lunatics and idiots. An inquest was held some time since in London, upon an idiot, who had bled to death from a wound of this description. When timely assistance is rendered, a fatal result may be averted. Incised, lacerated, or even contused wounds of the female genitals may prove fatal by hemorrhage, not from the wound involving any large vessel, but from the great vascularity of the parts. Two females were in this way murdered in Edinburgh some years since. The wounds were inflicted by razors, and the women bled to death. (See cases by Watson, p. 104.) This crime appears to have been at one time frequent in Scotland. When deeply *incised* wounds are inflicted on the genital organs of either sex, the fact of their existence in such a situation at once proves wilful and deliberate malice on the part of the assailant. Accident is wholly out of the question, and suicide is improbable, except in cases of confirmed idiocy and lunacy. Such wounds require to be carefully examined; for the proof of the kind of wound, when fatal, may be tantamount to the proof of murder. (For a case in which such a wound was homicidally inflicted upon a male, see Ann. d'Hyg. 1848, i. 443, and for another, which led to a trial for the murder of a female, see Med. Gaz. xliv. page 818.)

Contused wounds on the female genitals proves sometimes fatal by the laceration of parts leading to fatal hemorrhage. Several trials for manslaughter have recently taken place, in which this was proved to have been the cause of death.

(See the case of *Reg* v. *Cawley*, Liverpool Winter Assizes, 1847.) The only circumstance requiring notice is, that the hemorrhage may destroy life although no large blood-vessel be implicated in the injury. A case in which a contused wound of the clitoris has thus proved fatal, has been communicated to the Lancet by Mr. Gutteridge. (Oct. 31, 1846, 478.) A woman, æt. 36, received a kick from her husband in the lower part of the abdomen while she was in a stooping posture. She was seen by Mr. Gutteridge in about three-quarters of an hour, and had then lost from three to four pounds of blood. She was then sinking, and expired in a few minutes after his arrival. On inspection, there was no injury to the uterus or vagina; but the wound was seen at the edge of the vulva, extending from the pubis along the ramus of that bone. It was about an inch long and three-quarters of an inch deep. The left clus clitoridis was crushed throughout its length, so as to exhibit its cavernous structure. From this the fatal hemorrhage had proceeded. The heart and great vessels contained no blood. The hemorrhage from such injuries is always likely to be more profuse when the female is pregnant. A case of recovery from a contused wound to the genitals in a pregnant female, æt. 40, is reported by Dr. M'Clintock. It is stated that there was profuse hemorrhage from a laceration involving the urinary passage, but under early treatment the woman did well. (Medical Times, May 15, 1847, 233.) It is well known that some females are subject to frequent discharges of blood from the genital organs from natural causes. When the hemorrhage immediately follows a blow, and a female has not been subject to such a discharge, the fair presumption is that violence was the cause: but when the flow of blood appears only a long time after the alleged violence, of which no traces can be seen, it is most probably due to natural causes. An interesting case of this kind has been communicated to me by Mr. Proctor, of York. There was no difficulty in giving an opinion that the flow of blood was not due to violence.

CHAPTER XXXV.

FRACTURES—PRODUCED BY A BLOW WITH A WEAPON OR BY A FALL—OCCUR IN THE AGED—BRITTLENESS OF THE BONES—FRACTURES CAUSED BY SLIGHT MUSCULAR EXERTION—IN THE LIVING AND DEAD BODY—HAS A BONE EVER BEEN FRACTURED?—QUESTIONS OF SURVIVORSHIP—DISLOCATIONS FROM VIOLENCE OR NATURAL CAUSES—DIAGNOSIS—ACTION FOR MALAPRAXIS.

FRACTURES.

Fractures of the bones have some important bearings in relation to medical jurisprudence. They may result from falls, blows, or the spontaneous action of muscles.

Causes.—Questions are sometimes put as to whether a particular fracture was caused by an accidental fall or a blow; and if by a blow, whether by the hand or a weapon or not. It is obvious that the answers must be regulated by the circumstances of each case. In examining a fracture, it is important to determine, if possible, whether a *weapon* has or has not been used, and this may be sometimes known by the state of the parts. It is a common defence on these occasions, to attribute the fracture to an accidental fall. Fractures more readily occur from equal degrees of force in the old, than in the young; and in the young rather than in the adult; because, it is at the adult period of life that the bones possess their maximum degree of firmness and solidity. The bones of aged persons are sometimes very *brittle*, and slight violence will then produce fracture. This has been regarded as an extenuating circumstance, when the fracture was followed by death. Certain diseases, such as syphilis, arthritis, cancer, scurvy,

and rachitis, render bones more fragile; but they are sometimes more preternaturally brittle in apparently healthy persons, and this brittleness appears to be hereditary. (Dub. Hosp. Gaz. Feb. 1846, 189.) In such cases, a defence might fairly rest upon an abnormal condition of the bones, provided the violence producing the fracture was slight. Two trials have lately taken place where this fragility of the bones became a subject of discussion. But the fracture may be attributed to *spontaneous* causes, even supposing there are no well marked signs of disease. Thus bones have been fractured by moderate muscular exertion. The olecranon, os calcis, and patella, are particularly exposed to this accident. The long bones are very seldom the subject of an accident of this kind; but the os humeri in a healthy man has been broken, by the simple muscular exertion of throwing a cricket-ball. (Medical Gazette, xvi. 659.) Mr. May reports the case of a young lady, who fractured the neck of the scapula by suddenly throwing a necklace round her neck. (Med. Gaz., Oct., 1842.) It is probable that in these instances, if there were an opportunity of examining the bone, it would be found to have undergone some chemical change in its composition, which had rendered it brittle. An interesting case of spontaneous fracture of the femur was brought into Guy's Hospital in December, 1846. A healthy man, æt. 33, of temperate habits, was in the act of placing one leg over the other to look at the sole of his foot, when he heard something give way, and the right leg immediately hung down. On examination, it was found that the right os femoris had been transversely fractured at the junction of its middle with the lower third. This case is remarkable, inasmuch as spontaneous fractures of the thigh bones are very rare, —as the man had not suffered from any of those diseases which cause preternatural fragility, and the fracture was not caused by violent muscular exertion. The actual condition of the bone was of course unknown; but it healed readily, and the man left the hospital at the usual period. In fractures arising from this cause there will be no abrasion of the skin, or any appearance to indicate that a blow has been struck, while the marks of a blow would, of course, remove all idea of the fracture having had a spontaneous origin. Fractures are not *dangerous to life*, unless, when of a compound nature, they occur in old persons, or in those who are debilitated by disease or dissipated habits. They may then cause death by inducing irritative fever, erysipelas, gangrene, tetanus, or delirium tremens.

In the living or dead body.—It is not always easy to say whether a fracture has been produced *before or after death*. A fracture produced shortly after death, while the body is warm, and another produced shortly before death, will present much the same characters, except, perhaps, that in the former case there would be less blood effused. One caused ten or twelve hours before death would be indicated by a copious effusion of blood into the surrounding parts, and between the fractured edges of the bones, as well as laceration of the muscles; or if for a longer period before death, there may be the marks of inflammation. Fractures caused several hours after death are not accompanied by an effusion of blood. A medical witness may be asked, how long did the deceased survive after receiving the fracture? This is a question which can be decided only by an examination of the fractured part. Unless the individual has survived eighteen or twenty-four hours, there are commonly no appreciable changes. After this time, lymph is poured out from the surrounding structures. This slowly becomes hard from the deposition of phosphate of lime, and forms what is called "callus." In the process of time, this acquires all the hardness of the original bone. The death of a person may take place during these changes, and a medical man may then have to state the period at which the fracture probably happened, in order to connect the violence with the act of a particular person. Unfortunately we have no satisfactory data, if we except the extreme stages of this process, upon which to ground an opinion. We can say whether a person lived for a long or short time after receiving a fracture, but to specify the exact time is clearly impossible;

since this process of restoration in bone varies according to age, constitution, and many other circumstances. In young subjects, bones will unite rapidly, in the old slowly; in the diseased and unhealthy, the process is very slow, and sometimes does not take place at all. According to Villermé, the callus assumes a cartilaginous structure in from sixteen to twenty-five days; and it becomes ossified in a period varying from three weeks to three months. It requires, however, a period of from six to eight months, for the callus to acquire all the hardness, firmness, and power of resisting shocks possessed by the original bone. A force applied to a recently united bone will break it through the callus or bond of union, while after the period stated, the bone will break as readily through any other part. It is generally assumed, that the period required for the union of a simple fracture is, in the thigh-bone, six weeks; in the tibia, five weeks; in the os humeri, four weeks; and in the ulna and radius, three weeks; in the ribs, about the same period; but cases have been known where the ribs had not perfectly united in two months, and in some fractures of the other bones, union had not taken place in four months.

Has a bone ever been fractured? This question is sometimes put in reference to the *living* subject. It is well known that a bone seldom unites so evenly, but that the point of ossific union is indicated by a node or projection. Some bones are so exposed as to be well placed for this examination, as the radius, the clavicle, and tibia,—these being but little covered by skin; in others the detection is difficult. It is impossible for us to say when the fracture took place; it may have been for six months or six years, since, after the former period, the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as to the living; since they will enable us to answer questions respecting the identity of skeletons found under suspicious circumstances: and here medical evidence may take a wider range, for a fracture in any bone may be discovered, if not by external examination, at least by sawing the bone through the suspected broken part, when, should the suspicion be correct, the bony shell will be found thicker and less regular in the situation of the united fracture than in the normal state. So, in such cases, it will be easy to say whether a fracture is recent or of old standing. In the case of *Clark*, who was murdered many years since by Eugene Aram, the traces of the fracture and indentation of the temporal bone were plainly distinguished on the exhumation of the skeleton of the deceased, thirteen years after the perpetration of the murder. The manner in which the murder was committed was confessed by an accomplice, and the medical evidence corroborated this confession. An instance of the utility of this kind of knowledge came out on the trial of a gentleman in India, in 1833, for the murder of a native, *Meer Khan*. There was some reason to suppose that the prisoner had been falsely accused of causing the death of the native. Two witnesses deposed that a few hours before the death of the deceased, the prisoner had struck him several blows on the chest, and had broken his ribs. The alleged murder having taken place some months previously to the trial, a skeleton was produced as being that of the deceased, by one of the persons who had assisted in burying the body. On examining the ribs, the medical witness found that only one rib was broken, and the fractured portions were united by a firm osseous callus. He, therefore, declared, that the fracture could not have been caused a few hours before death; but that it must have existed for a period of at least eight or twelve days. Hence the account given by the witnesses was rendered improbable; for the prisoner had used no violence to the deceased, except just before his death: the fracture, therefore, must have taken place from another cause some time previously. The witness much understated the period at which the fracture probably occurred; for ossification only commences in the cartilage about the sixth day; and the specks of bony matter continue to increase from the eighth to the twelfth day, but the union is soft, and some weeks elapse before the callus becomes perfectly firm and hard.

Locomotion.—With respect to the power of *locomotion* after a fracture, it may be observed, that when the injury is in the arm or in the ribs, unless many of them be broken, an individual may move about, although unfitted for great exertion. Fractures of the leg incapacitate a person from moving except to very short distances. See case by Syme, Ed. Med. and Surg. Journ., Oct. 1836. (The reader will find additional information on this subject in the Ann. d'Hyg. 1839, ii. 241; and 1844, ii. 146.)

DISLOCATIONS.

Dislocations are not very frequent in the old or in those persons whose bones are brittle. They rarely form a subject for medico-legal investigation. A witness is liable to be asked, what degree of force, and acting in which direction, would produce a dislocation,—a question not difficult to answer. They are not dangerous to life, unless of a compound nature, when death may take place from secondary causes. A dislocation which has occurred in the *living body* would be known after death by the laceration of the soft parts in the neighbourhood of the joint, and by the copious effusion and coagulation of blood. For a good account of the post-mortem appearances four days after a dislocation of the humerus, see Med. Gaz. xxxi. 266. If of old standing, a dislocation would be identified by the cicatrices in surrounding structures. Dislocations may occur from *natural causes*, as from disease and destruction of the ligaments in a joint, also from violent muscular spasm during an epileptic convulsion. Dr. Dymock met with an instance of dislocation of the humerus forwards during puerperal convulsions. (Ed. Med. and Surg. Journ., April, 1843; see also Lancet, April, 1845, 440.) *Locomotion* may exist except when the injury is in the lower extremity, and even then it has been observed, that for some time after a dislocation of the hip-joint, considerable power over the limb remains; it is only after a few hours that it becomes fixed in one position. Exertion with the dislocated member is in all cases out of the question.

Diagnosis—malapraxis.—There are certain fractures of an obscure kind which closely resemble dislocations. This has been pointed out by Sir A. Cooper, in relation to fractures in the anatomical neck of the os humeri. (Guy's Hosp. Rep. ix. 272.) This accident might be easily mistaken for a dislocation of the shoulder. (Med. Gaz. xxxvi. p. 38.) In attempting to reduce the bone, the head continually falls back into the axilla. In such a case an action for malapraxis might be brought against a surgeon, and heavy damages recovered. It could only be by a dissection of the part after death that the real nature of the case would be ascertained. It is requisite, therefore, that great caution should be used in the diagnosis. The same observations apply to fractures of the neck of the thigh-bone, although with less force, because this is a much more common accident. It is well known that fractures and dislocations, when cured, are often attended either with some slight *deformity* of the limb, or with some impairment of its functions. This result is occasionally inevitable under the best treatment; but it is commonly set down as a sign of unskilfulness in the medical attendant. Actions for malapraxis are instituted, and in spite of good evidence in his favour, the surgeon is sometimes heavily fined for a result which could not be avoided. There is often great injustice in these proceedings, and the mischief can only be remedied by referring the facts to a medical tribunal, which alone should be competent to decide whether or not unskilfulness had really been shown in the management of a case.

CHAPTER XXXVI.

GUN-SHOT WOUNDS—THEIR DANGER—ON THE LIVING AND DEAD BODY—WAS THE PIECE NEAR OR FROM A DISTANCE?—EVIDENCE FROM SEVERAL WOUNDS—THE PROJECTILE DISCOVERED—DEFLECTION OF BALLS—ACCIDENTAL, SUICIDAL, OR HOMICIDAL WOUNDS—POSITION OF THE WOUNDED PERSON WHEN SHOT—WOUNDS FROM SMALL SHOT—FROM WADDING AND GUNPOWDER—IDENTITY FROM THE FLASH OF POWDER—EXAMINATION OF THE PIECE.

GUN-SHOT wounds are of the contused kind, but they differ from other wounds in the fact that the vitality of the parts struck by the projectile is destroyed, and this leads ultimately to a process of sloughing. The legal definition of a wound applies here as in other cases, so that, in order to constitute a gun-shot wound within the meaning of the act, the cutis, or true skin, must be injured. In the case of The *Queen against Mortlock* (Cambridge Lent Assizes, 1841), the surgeon deposed that there was a circular wound on the skin, by which it had been deprived of its cuticle, but the true skin was not penetrated. The ball had struck obliquely at a very considerable angle: had it been otherwise it must have entered the abdomen. The judge said that, as the true skin was not penetrated, there was no wounding within the meaning of the statute.

Their danger.—The medico-legal questions which arise out of gun-shot wounds, are much the same as those which have been examined in relation to other wounds. They are very *dangerous to life*, more especially when they penetrate or traverse any of the great cavities of the body. Death may take place directly from hemorrhage or shock; although immediate or copious hemorrhage is not a common character of these injuries. Death from shock is occasionally witnessed. In the case of the policeman *Daly*, who was killed by a pistol-ball in Hornsey Wood, May, 1842, it was found, on inspection, that the bullet had traversed the distended stomach at the cardiac end from behind forwards. The two apertures were about the size of a shilling, and the edges black. There was but little blood effused, and the other viscera were uninjured. The deceased died a few seconds after receiving the wound, obviously from a shock to the nervous system. (Lancet, May, 1842.) Indirectly, these wounds are attended with much danger; sloughing generally takes place uniformly throughout the whole of the perforation, and inflammation or fatal hemorrhage may cut short life. If the individual survive the first effects, he may die at almost any period from suppurative fever, erysipelas, gangrene, or from the results of operations absolutely required for his treatment. Gun-shot wounds may thus destroy life after very long periods of time. Marshal Maison, one of Napoleon's generals, died in Paris in 1840, it is said from the effects of a gun-shot wound received forty years before. In gun-shot wounds of a severe kind, the first symptoms do not always indicate the degree of mischief. Thus in the case of Mr. Drummond, who was shot by *M'Naughten*, in January, 1843, the symptoms were in the first instance so slight, that the bullet was supposed not to have penetrated the cavity of the abdomen, but to have coursed round the skin. Death took place in a few days, and it was then found that the bullet had completely traversed the abdomen, perforating the diaphragm. Army surgeons have also remarked that slight wounds of the parietes are often insidiously attended with deep-seated injury. Death might in such a case be improperly ascribed to mismanagement, when it may have been really due to the wound. (See cases by Mr. Alcock, Med. Gaz. xxiv. 850.) It is not easy to mistake a gun-shot wound from any other injury. If the circumstances under which it is produced do not satisfactorily account for its origin, a simple examination will suffice to show its true nature. Sometimes the projectile or part of the dress is found lodged in the wound.

On the living and dead body.—A medical witness may be asked, whether the wound was inflicted *before or after death*. It is by no means easy to answer this question, unless the bullet has injured some vessel, when the effusion of blood, and the formation of coagula, will indicate that the person was living when it was received. In a gun-shot wound on the dead, no blood is effused, unless the bullet happens to strike a vein.

Was the piece fired near or from a distance?—A gun-shot wound produced by the muzzle of the piece being placed near to the surface of the body, has the following characters:—There may be two apertures, the one of entrance and the other of exit; but it sometimes happens that the bullet lodges and does not pass out. The edges of the aperture of entrance are torn and lacerated, and appear blackened, as if they had been burnt; this arises from the heat and flame of the gunpowder at the moment of explosion. The skin is often ecchymosed, and is much blackened by the powder:—the clothes covering the body are blackened by the discharge, and sometimes ignited by the flame. If the muzzle of the piece was not in immediate contact with the part struck, the wound is rounded; but if there has been direct contact, the skin, besides being burnt, is torn and much lacerated. The hemorrhage is usually slight, and when this occurs it is more commonly observed from the orifice of exit, than from that of entrance. It should be remarked, that the aperture of entrance is round, only when the bullet strikes point-blank or nearly so. If it should strike obliquely, the orifice will have more or less of an oval or valvular form, and in this way we may sometimes determine the relative position of the assailant with respect to the wounded party. Supposing the bullet to have been fired from a moderate distance, but so near as to have had sufficient momentum to traverse the body, then the appearance of the wound will be different. The orifice of entrance will be well defined, round or oval, according to the circumstances,—the skin slightly depressed,—the edges presenting a faint bruised appearance, but the surrounding parts are neither blackened or burnt, nor do they present any marks of hemorrhage. In all cases the orifice of exit is large, irregular, the edges somewhat everted, and the skin lacerated, but free from all marks of blackness or burning: it is generally three or four times as large as the entrance-aperture. This is denied by Dr. Malle (Ann. d'Hyg. 1840, i. 458,) but it appears to me upon insufficient grounds. The orifice of entrance is, however, always large and irregular, when the bullet strikes near the extremity of its range. Under common circumstances, the entrance-aperture has generally the appearance of being smaller than the projectile, owing to the elasticity of the living skin. (Ann. d'Hyg. 1839, ii. 319.) It is the same with the aperture in the dress, when this is formed of an elastic material:—according to Dupuytren, the hole in the dress is always smaller than that made by the bullet in the integuments. These points should be remembered in fitting projectiles to wounds which they are supposed to have produced. [Dr. Griffith reminds us that the appearance of a wound from a rifle ball is very different from that caused by a musket or pistol ball. From the spiral groove in the barrel of the American rifle, and the tightness with which the ball fits, this latter also assumes a spiral motion in its progress, and hence makes a ragged hole, much larger than itself, and much more frequently shatters a bone than is deflected by it.—H.] Useful evidence may be sometimes obtained by a careful examination of the *projectile*, the identity of which should be preserved by the medical witness. When the projectile cannot be found, and there are no marks of burning, or other signs of a near wound on the skin, we must be cautious in making a diagnosis. Mr. Ward has reported a case in which a perforating wound of the skull closely resembled a bullet wound. (Med. Gaz. xliv. 767.)

The question whether a piece was fired *near to or at a distance* from the wounded party, may become of material importance on a charge of homicide, or of alleged suicide. Two persons may quarrel, one having a loaded weapon in

his hand, which he may allege to have been accidentally discharged, and to have killed the deceased. If the allegation be true, we ought to find on the body the marks of a near-wound: if, however, it were such that it had been produced from a distance, and therefore after the quarrel, the medical proof of this fact might imply malice, and involve the accused in a charge of murder. The following case occurred in Ireland in 1834:—A tithe-collector was tried for the murder of a man, by shooting him. It appeared in evidence, that the prisoner, while on duty, was attacked by the deceased and two of his sons, and he drew a pistol to intimidate them. He was dragged off his horse by these parties, and during the scuffle, it is supposed, the pistol accidentally went off, and inflicted a wound on the deceased, of which he died shortly afterwards. The sons of the deceased swore that the prisoner, when at some distance, took a deliberate aim, and fired the pistol at their father; and a priest came forward to depose that such was the dying declaration of the deceased. From some subsequent suspicion of the truth of this story, the body, which had not been properly inspected in the first instance, was ordered to be disinterred. It was carefully examined by a surgeon, who was enabled to swear positively that the pistol must have been fired close to the body of the deceased, and not at a distance; since there were the marks of powder and burning on the wrist. Hence it clearly followed, that the pistol had been discharged during the scuffle, either by accident or in self-defence. The prisoner was acquitted, and the parties who had appeared as witnesses against him were indicted and convicted of perjury. In the case of *Mr. Pearce*, a surgeon who was tried at the Central Criminal Court, in 1840, for shooting at his wife, and was found insane, it appeared from the medical evidence that the pistol had been fired so near to the person of the prosecutrix, that her dress was burnt and the skin blistered. Mr. Marshall relates that when stationed at Ceylon with troops, a man, who had but recently joined the regiment, was placed as sentry in a position where he was occasionally fired at by the enemy from the surrounding jungle. The man was one day found severely wounded; the calf of his leg was greatly torn; the whole charge of a musket having passed through it. He attributed the wound to a shot from the enemy, but from the skin of the leg being completely blackened by charcoal, it is clear that it must have arisen from the discharge of his own musket. He had inflicted this wound upon himself, in order to obtain a discharge from the regiment. These examples, then, show that both the dress and skin of a person who has received a gun-shot wound should be closely examined. The result may be, that the statement given of the mode in which the wound was received will be entirely disproved. The case of *M. Peytel*, tried in France, in September, 1839, presents many points of great interest in relation to the medical jurisprudence of gun-shot wounds. This gentleman was travelling in a carriage, in company with his wife, and attended by a man-servant. The wife and the man-servant were found dead on the road, and the account given by M. Peytel was, that the servant had discharged a pistol into the carriage and shot his wife, and he had afterwards pursued and killed him. The facts, however, were so suspicious against M. Peytel, that he was charged with the double murder. From an examination of the body of the wife, it appeared that there were two pistol wounds in the face which had most probably been produced by two separate pistols. The prisoner alleged that about nine o'clock at night, when it was dark, he desired the servant to get down in order to relieve the horses. Two minutes afterwards, some man, whom he found to be the servant, approached the carriage-door, discharged a pistol at him, and wounded his wife; but the evidence showed that two weapons must have been used, or at least two different discharges made by a person sitting very near to the deceased, so that the muzzles must have almost touched her face, the eyelashes and skin having been much burnt by the powder. These facts, together with other strong circumstances against him, led to the prisoner's conviction. The late Dr. Ollivier, who appeared in the prisoner's favour, considered that the

deceased might have been shot by the servant, and that the two wounds might have been produced by one pistol loaded with two bullets; also, that the marks of burning about the face of the deceased might be attributed to the wadding, and therefore they afforded no proof that the muzzle of the pistol had, at the time of its discharge, been close to her person. He also contended that the deceased had not died from the wounds. Notwithstanding these ingenious medico-legal arguments, there can be no doubt that the prisoner was very properly convicted. (See Ann. d'Hyg. 1839, ii. 339; 1842, i. 368.)

It has been said that when a bullet is fired near, it commonly traverses; and therefore it has been rather hastily assumed, that where there is only one external wound, and the bullet has lodged, this is a proof that the piece has been fired from a distance. This interference is, however, erroneous. A bullet may be fired closed to a person, and yet not traverse the body, either from its impulsive force not being sufficiently great, or from its meeting a great resistance in the body. Many cases might be cited to show, that in the near wounds produced by suicides and murderers, the bullets have not always traversed the body. In suicide, where the piece is discharged into the mouth, the projectile often lodges in some part of the cranium.

Evidence from several wounds.—When several wounds are found on a body,—can we determine whether they were produced by one or several different discharges? This question was raised in *Peytel's* case, as there were two wounds on the deceased, and the prisoner alleged that the servant had fired but one pistol. M. Ollivier thought this might be explained by supposing that there had been two bullets in the pistol:—it was, however, affirmed by some military officers and other witnesses, that these wounds had been produced by separate pistols, a fact which overthrew the defence of the prisoner. (Ann. d'Hyg. 1842, i. 368.) It is proper to remark that one ball may produce several wounds on the body: there will be only one orifice of entrance, but owing to the ball occasionally splitting within the body, and dividing itself into three or four pieces, there may be several orifices of exit. The splitting of balls has repeatedly occurred where the projectile in its course has encountered an angular surface, or a projecting ridge of bone. Dupuytren met with an instance, where a ball, after having struck the ridge of the tibia, divided itself into two parts, which traversed the calf of that leg, and penetrated into the calf of the opposite leg. Thus no less than five wounds were produced in one instance by a single ball; three of entrance and two of exit. Had this man been found dead, and nothing known concerning him, this singular circumstance would probably have given rise to considerable embarrassment.. After a careful examination, a surgeon might have been induced to declare that this person must have received at least three distinct shots. A similar effect was observed in another case, where the bullet struck the parietal bone and divided itself into two portions:—one passed out superficially through the integuments, the other penetrated into the brain, and lodged on the tentorium. This fact shows that the discovery of an exit-aperture does not always prove that the whole of a projectile has passed out,—a matter which may influence the prognosis.

Deflection of balls.—When a ball traverses the body, it sometimes happens that the two apertures are opposite to each other, although it may not have taken a rectilinear course between them, but have been variously deflected by the subjacent soft parts. This deflection of a ball from a rectilinear course is especially met with in those cases where it happens to strike obliquely a curved surface, and it is found that when the ball enters and does not pass out, its course is often extremely circuitous, so that it is not always easy to say in what part of the body it may be found. In 1830, I saw, at the Hôtel-Dieu, a boy who had received a gun-shot wound in the upper part of the abdomen: the entrance-orifice was very plainly situated there, but there was an opening at the back, nearly diametrically opposite, out of which the ball had passed, so that it conveyed the impression

that the ball had completely traversed the abdominal cavity. There was no sign of collapse or depression, nor any indication of serious injury; and Dupuytren gave an opinion, which was afterwards verified,—that the ball had not penetrated, but had been deflected beneath the skin, and had taken a circuitous course through the cellular membrane to the back. Many similar facts are recorded. The same deflection may occur even when the piece is discharged close to the body, as in cases of suicide. Mr. Abernethy was once called to examine a man, who had shot himself, as it was supposed, through the head. He found two openings in the scalp, nearly opposite to each other: it was soon perceived, on examination, that the ball had not penetrated the bone, but had followed the curve of the exterior of the skull to its point of exit. The deflection of projectiles may occur not merely when they come in contact with bone, but when they meet skin, muscles, tendons, and fasciæ,—the ball then takes its course in the spaces between these different structures. A ball which entered at the ankle has been known to make its exit at the knee; and another, which entered at the back of the left shoulder, passed down on the inside of the scapula, and was found below the right ear. This deflection of balls by such slight obstacles has been ascribed partly to the obliquity with which they strike, and partly to the rotatory motion on its axis which every spherical projectile is considered to have. It does not appear to be much connected with the degree of velocity, for the same deviation has been found to occur when the bullet was fired near or at a distance.

If we can at any time discover two fixed points where the ball has touched a building, without being reflected, it will be easy to determine the *situation* from which the piece was discharged. A singular example of this kind is stated by Mr. Watson to have occurred at Ayr in 1831. Several shots had been maliciously fired into a church. Some of the bullets traversed a window, making holes in the glass, and stuck against a wall on the other side of the church,—a fact plainly indicated by the marks which they left. A straight line carried from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained the bullets had been fired.

Survivorship.—A witness may be asked—When was the gun-shot wound inflicted, and how long had the wounded party *survived* after receiving it? A gun-shot wound undergoes no change for eight or ten hours after its infliction. Our judgment may be assisted by observing what parts are involved, although we cannot always infer, from the quantity of blood found near, that the hemorrhage was an immediate consequence of the wound, or that the whole of the blood was effused at once. We cannot, then, always affirm that the deceased could not have moved or exerted himself in some degree, after receiving it. The exertion thus made subsequently to his being wounded may have actually caused the fatal hemorrhage.

Accidental, Suicidal, or Homicidal wounds.—When it is doubtful whether the wound was the result of accident, suicide, or homicide, the point may be often settled by paying attention to its situation and direction. Suicidal gun-shot wounds are almost always directed to a vital part—to the heart or to the brain:—they possess those characters which belong to wounds inflicted near to the body: the skin is blackened or burnt, the wound wide and lacerated,—the hand which discharged the weapon often blackened,—and sometimes still grasping the pistol. The ball may or may not have traversed, as this will depend on the momentum which it derives from the charge, and the resistance which it experiences. (See the case of The *Queen* v. *Thomas*, Brecon Lent Assizes, 1845.) The situation in this instance negatived the supposition of suicide. Suicidal gun-shot wounds are seldom situated at the posterior surface of the body; therefore the determination of the point of entrance, if the ball has traversed, is of some importance. The direction of these wounds is probably of less moment than their situation, because the projectile is liable to be deflected in the body. In a duel which occurred in Paris, in 1827, one of the parties, a tall man, was

killed by a ball which was found to have entered below the right shoulder, and to have taken a direction downwards. In consequence of this, it was thought that he had been shot unfairly by his antagonist, who was short in stature. Breschet and others explained the suspicious course of the wound, by saying that the ball had struck the under part of the clavicle, and had thence probably been deflected downwards.

Accidental wounds also bear the characters of near wounds:—they may touch vital parts, but if the body be not disturbed, the presence or absence of design in the infliction of the wound is commonly made apparent by the relative position of the body and the weapon. They frequently arise from persons drawing the charges of guns or pistols with the muzzles pointed towards them, and they are then situated in front:—at other times they are produced by persons pulling towards them through a hedge, or dragging after them, a loaded gun. In the latter case the wound is behind, and strongly resembles a homicidal wound, although the circumstances under which the body is found generally suffice to explain the matter. In the following case of attempted suicide, the characters of the wound somewhat resembled those which are commonly imputed to homicide. In March, 1844, a man was brought to Guy's Hospital, with a large ragged gun-shot wound on the right side of the head, behind the angle of the jaw, and between it and the ear. No slugs or bullets could be found; the direction was from behind forwards, and from above downwards. According to this man's statement, the pistol missed fire three times, but he succeeded in discharging it into his mouth at the fourth attempt. He lost a large quantity of blood, but after some time he walked to a table at the distance of five yards, reloaded the pistol, and discharged it at the back of his head in the situation described. Thus, then, there were in this case two wounds, one homicidal in its characters; and a power of locomotion after the first wound, in spite of considerable hemorrhage. A gun-shot wound in the mouth or temple would seldom be set down to accident, and yet attempts are occasionally made to ascribe to such wounds an accidental origin. The admission of a near wound in the temple occurring from accident, must depend entirely upon the circumstances proved. (See the case of *Reg.* v. *Tottenham*, Norwich Lent Assizes, 1845.)

Position of the wounded person when shot.—Did the deceased receive the shot while standing, falling, or lying down? Was the piece, when discharged, pointed from the shoulder? These questions can only be answered by reference to the particular circumstances of the case. In general, when a person is shot while standing, and the piece is pointed from the shoulder, the wound is more or less transverse; but due allowance must be made for the deflection of balls after penetration. (The *Queen* v. *Magarity*, Central Criminal Court, July, 1841.)

Was the deceased shot while running away, or when approaching the person who fired?—This question is answered by observing, in the case of a traversing wound, in which alone any difficulty can arise, whether the entrance-orifice be situated in front or behind. A trial took place at the Kent Assizes, some years since, in which this question was material.

Wounds from small shot.—Death is sometimes occasioned by small shot, and here several medico-legal questions present themselves. Small shot may act in two ways:—1, it either strikes without spreading, in which case the discharge is always near the person, and its action is much more dangerous than that of a single ball, because it produces extensive lacerations; or, 2d, it strikes after it has spread, and here the discharge must have been distant, and comparatively little mischief is done. Dr. Lachése ascertained, by many experiments, that in order to produce, with small-shot, a regular round opening like that resulting from a bullet, the discharge should not take place at a distance greater than ten or twelve inches from the surface of the body. When the distance was from twelve to eighteen inches, the opening made was irregular, and the borders were much lacerated; at thirty-six inches, a central opening was entirely lost, and the

surface of the body was covered by shot. The effect after this was found to depend on the distance, the goodness of the gun, and the strength of the charge (Ann. d'Hyg. 1836, 386;) but the shot is in general much scattered over the surface of the body. In this way, we may form an opinion of the distance at which the piece was fired. In the case of The *Queen* v. *Chapman* (Oxford Lent Assizes, 1839,) it was proved that the deceased had been killed by small shot fired from a gun; that the discharge must have taken place very near, as the shot had not been scattered, and the point of the gun must have been below the level of the wound, as the direction was rather upwards. Two medical witnesses were examined, and both agreed that the gun, when fired, could not have been pointed from the shoulder, judging from the direction of the wound. A similar question was raised, and it was decided that the discharge of the gun took place accidentally during a struggle, in the case of *Rey.* v. *Hull* (Oxford Summer Ass. 1846.) The case of The *Queen* v. *Kendrew* (York Winter Assizes, 1844,) is in this respect of some medico-legal importance. The medical evidence was very satisfactory. It was shown to be highly improbable that deceased could have shot himself with small shot from a gun, as the shot were scattered, and there was no round opening. It can seldom happen that a circular wound will be made by small shot without the dress being singed or burnt. A wound of this description must not, however, be mistaken for one produced by a bullet.

Small shot are rarely observed to traverse the body entirely, unless discharged so near as to make a clean round opening; but a single pellet reaching the body may destroy life. Two cases have already been mentioned; one where a young man was killed by a single pellet wounding the fifth intercostal artery; the other, where a girl was killed by a pellet traversing the orbitar plate and wounding the brain. Such minute wounds might be easily overlooked in an examination of the body. Small shot, even when wounding only the skin of the back very superficially, has been known to cause death by tetanus.

Wounds from wadding and gunpowder.—It matters not with what the piece is charged,—it is capable, when fired near, of producing a wound which may prove fatal. Thus, a piece loaded with wadding, or even gunpowder only, may cause death. In all these cases, an impulsive force is given by the explosion, and the substance becomes a dangerous projectile. The lighter the projectile, the shorter the distance to which it is carried; but when discharged near to the body, it may produce a fatal penetrating wound. A portion of the dress of the individual may be carried into the wound, and lead to death from hemorrhage; or if the wounded person recover from the first effects, he may subsequently sink under an attack of tetanus or erysipelas. It is unfortunate that so much ignorance prevails on this point; for fatal accidents are continually occurring from persons discharging guns at others in sport,—an act which they think they may perform without danger, because they are not loaded with ball or shot. In the case of The *Queen* v. *Race* (Bury Lent Assizes, March, 1840,) it was proved that the prisoner had killed the deceased by discharging at him, within a few feet, a gun loaded with powder and paper-wadding. This was done out of a joke at a fair. The deceased fell, and died in a few minutes: it was found that the chest was penetrated, and that the wadding had wounded the left auricle of the heart.

It has been observed that persons, in attempting to commit suicide, have occasionally forgotten to put a bullet into the pistol: nevertheless, the discharge of a piece into the mouth has sufficed, from the effect of the wadding only, to produce a considerable destruction of parts, and to cause serious hemorrhage. Fatal accidents have frequently taken place from the discharge of wadding from cannon during reviews. It is not easy to say at what distance a weapon thus charged with wadding and powder would cease to produce mischief, since this must depend on the impulsive force given by the powder, and on the size of the piece. Dr. Lachése has ascertained, by experiment, that a piece charged with gunpowder is capable of producing a penetrating wound somewhat resembling that caused

by small shot, when the piece is large, strongly charged, and fired within six inches of the surface of the body. (Ann. d'Hyg. 1836, 386.) This arises from a portion of the powder always escaping combustion at the time of discharge, and each grain then acts like a pellet of small shot. Under any circumstances, a discharge of powder only contuses the skin, producing ecchymosis, and often lacerating it, if the piece be fired near. The dress is burnt and the skin scorched from the globe of flame formed by the combustion of the powder: many particles of gunpowder may be actually driven into the true skin. All the substances here spoken of are considered to be projectiles; the weapons are held in law to be loaded arms, so long as they are capable of producing bodily injury at the distance from which the piece containing them is discharged. It may therefore become a question as to the distance at which these light projectiles cease to be harmless. The answer must be governed by circumstances; but it will in all cases materially depend on the strength of the charge. In the case of *Reg.* v. *Collier*, (Abingdon Lent Assizes, 1844,) the prisoner was charged with firing a gun loaded with small shot at the prosecutor, with intent to do grievous bodily harm. It appeared that the gun was deliberately pointed at the prosecutor, who was then at a distance of from seventy to eighty yards from the prisoner. The shot, which was very small, had marked the clothes, but had not penetrated the skin or inflicted any wound. The defence was, that from the slight injury done, the prisoner merely intended to frighten the prosecutor, and not to do him any bodily harm. He was found guilty of a common assault. The question was here a delicate one, for had the prosecutor been a few yards nearer, and the pellets touched an exposed part of the body, the result might have been serious. One pellet has destroyed life, (ante, p. 268.) A case has recently occurred in the United States, involving the question, as to the distance at which a pistol, *not* loaded with ball, would suffice to produce a serious wound. A boy, in play, discharged a pistol at a companion, producing on the fleshy part of the left hip a wound one inch in diameter and four inches in depth. The integuments were destroyed, and the muscles presented a blackened lacerated mass. There was no ball in the pistol; but it is not certain whether there was wadding. Death took place from tetanus on the seventh day; and, on examination, no wadding was found in the wound. There were, however, grains of gunpowder, with which the wound was blackened throughout its whole extent. At the inquest the witnesses differed respecting the distance at which the pistol was held at the time the wound was inflicted. Some said one foot, others two or three yards. The deceased stated his belief that the pistol almost touched him, and, judging by the state of the wounded parts, this was probably the truth. Dr. Swift believed that the wound had been produced by gunpowder only, without wadding. He performed some experiments with the pistol used by the prisoner, but loaded with gunpowder and *wadding*, in order to determine the effects of discharges at different distances. At twelve inches distance from a body, he found that the clothes were lacerated and the skin abraded, but the wadding did not penetrate: at six inches, the clothes were lacerated, and the wadding penetrated to the depth of half an inch; at two inches the wound produced, which was two inches deep, was ragged and blackened; at one-and-a-half inches from the chest, the wadding passed into the cavity between the ribs, and in a second experiment it carried away a transverse portion of a rib. (Med. Gaz. xl. 734.) These results confirm those obtained by Dr. Lachése.

Identity from the flash of powder.—Among the singular questions which have arisen out of this subject is the following: Whether a person who fires a gun or pistol at another during a dark night, can be identified by means of the light produced in the discharge? This question was first referred to the class of Physical Sciences in France, in 1809, and they answered it in the negative. A case tending to show that their decision was erroneous was subsequently reported by Foderè. A woman positively swore that she saw the face of a person who fired at another during the night, surrounded by a kind of glory, and that she was thereby ena-

bled to identify the prisoner. This statement was confirmed by the depo of the wounded party. Desgranges, of Lyons, performed many experiments this subject, and he concluded that on a very dark night, and away from source of light, a person who had fired the gun might be identified within a derate distance. If the flash were very strong, the smoke very dense, and distance great, the person firing the piece could not be identified. The qu was raised in this country, in the case of The *Queen* v. *White*, at the Cas Autumn Assizes, 1839. A gentleman was shot at while driving home in gig during a dark night: he was wounded in the elbow. When he observed flash of the gun, he saw that it was levelled towards him, and the light of flash enabled him to recognise at once the features of the accused:—in cro amination he said he was quite sure he could see him, and that he was not taken as to his identity. The accused was skilfully defended, and he was quitted. Evidence of this kind has, however, been received in an English C of Law. A case is quoted by Paris and Fonblanque, (*Rex.* v. *Haines*,) in w some police-officers were shot at by a highwayman during a dark night. O the officers stated that he could distinctly see, from the flash of the pistol, the robber rode a dark-brown horse of a very remarkable shape in the hea shoulders; and that he had since identified the horse in a stable in London also perceived, by the same flash of light, that the person had on a rough gr great coat. This evidence was considered to be satisfactory.

From the information which I have been able to collect on this point it pears to me there can be no doubt, that an assailant may be thus occasi identified. It is widely different, however, in respect to the following c ferred to by Müller, in his Physiology; namely, where a man declared th recognised a robber through the light produced by a blow on his eye in the d As Müller observes, this is a clear impossibility; because the flashes thus p ceived are unattended with the emission of light, and therefore can never visible to any other person than the subject of them, nor is it possible that can ever make any other objects visible. [For some remarks on this subject Dr. Schilbach, see Henke's Zeitschrift der S. A. 1842, i. 197.] Dr. Krüger has lately opposed the inference deduced by Müller, and has supported his vie by cases, which, however, do not appear to me to be satisfactory. (Henke Zeitschrift der S. A. 1845, iii. 172.)

Chemical examination of fire-arms.—An attempt has been made by Fren medical jurists to determine for how long a period a gun or a pistol lying ne a dead body may have been discharged; but it is out of our power to lay dow any precise rules on such a subject. All that we can say is, a quantity of sulphuret of potassium, mixed with charcoal, is left adhering about the bre of the piece, when *recently* discharged; and this is indicated by its forming strong alkaline solution with water,—evolving an odour of sulphuretted hydro gen, and giving a deep brown precipitate with a solution of acetate of lead. After some hours or days, according to the degree of exposure to air and moistur the saline residue becomes converted to sulphate of potash, forming a neutral solution with water, and giving a white precipitate with acetate of lead. If the piece has been discharged for a considerable time, oxide of iron with traces of sulphate may be found. (See Ann. d'Hyg. 1834, 458; 1839, 197; 1842, 361.) This subject has recently excited some attention on certain trials which have taken place in France in reference to the death of *M. Dujarrier*. It was con sidered here of some importance to determine whether, by the mere discharge of powder, such a deposit of charcoal or powder took place at the mouth of the pistol, as to soil the finger when introduced three hours after the alleged dis charge. M. Boutigny conducted the investigation, and found in his experi ments that the finger was not blackened under the circumstances. He con siders that sulphate and carbonate of potash are formed, and that the charcoal is entirely consumed. The facts proved at the trial were, however, adverse

to the view thus taken; and it really appears that this most elaborate inquiry, involving physics, chemistry, and mathematics, might have been spared, on the simple ground that the result produced by a discharge of powder in the way supposed must depend on the quantity of powder employed (its perfect or imperfect combustion,) and the proportion of charcoal contained in it! The elements for solving such a strange pyrotechnic question must therefore in most, if not in all cases, be wanting. (Ann. d'Hygiène, 1848, i. 392.)

Examination of fire-arms and projectiles.—In the case of *Rush*, who was tried and convicted of the murder of *Mr. Jermy*, by a remarkable train of circumstantial evidence (Norwich Lent Assizes, 1849,) it was proved that the projectiles removed from the body of the deceased consisted of irregular pieces of lead (slugs.) Similar masses were taken from the body of the son, who was killed at the same time. They were described by the medical witness as being angular, and quite unlike the shot used in killing game. Each piece weighed from eleven to thirteen grains, and there were fifteen pieces in all. As the learned judge remarked, this demonstrated that the two acts of murder were committed by the same person, or by this person acting in concert with others.

The chemical analysis of the projectile may be occasionally necessary. A common bullet is entirely formed of lead. Cast bullets are very commonly found to have a void space in the interior when cut through the centre, owing to the exterior cooling more rapidly than the interior, and the greater bulk of the metal when in the liquid state. In large bullets this cavity is frequently of the size of a barleycorn. Bullets obtained by compression have no such space, and are of very great specific gravity. Small shot consist of lead with a minute fractional proportion of arsenic ($\frac{1}{100}$th part.) If the arsenic be in large proportion the shot is lenticular—if absent, or in small proportion, pyriform (Ure.) In the case of *Rush*, type metal was found in the house. This consists of lead with one-fourth part antimony, the latter being left by digestion in nitric acid. It was, therefore, considered advisable to examine the slugs chemically, and they were found to consist chiefly of lead, and to contain no antimony. Fortunately the evidence here sought for was not necessary for conviction.

CHAPTER XXXVII.

BURNS AND SCALDS—CIRCUMSTANCES WHICH RENDER THEM DANGEROUS TO LIFE—DID THE BURNING TAKE PLACE BEFORE OR AFTER DEATH?—EXPERIMENTS ON THE DEAD BODY—VESICATION AND LINE OF REDNESS—PRESENCE OF SEVERAL BURNS—SUMMARY. ACCIDENT, HOMICIDE, OR SUICIDE—HUMAN OR SPONTANEOUS COMBUSTION—BURNS BY CORROSIVE LIQUIDS—SPONTANEOUS IGNITION OF ORGANIC AND MINERAL SUBSTANCES.

BURNS AND SCALDS.

A *Burn* is an injury produced by the application of a heated substance to the surface of the body; while a *Scald* results from the application of a liquid, at or near its boiling point, under the same circumstances. There seems to be no real distinction between a burn and a scald as to the effects produced on the body:—the injury resulting from boiling mercury or melted lead might take either appellation. Nevertheless, as a matter of medical evidence, it may be important to state whether the injury found on a body was caused by such a liquid as boiling water, or by a heated solid. If the former, the injury might be ascribed to accident; if the latter, to criminal design. A scald produced by boiling water would be indicated by a sodden state of the skin, and there would be no loss of substance. In a burn by a heated solid, the parts may be more or less destroyed, or even charred: the cuticle may be found blackened, dry, almost of a horny con-

sistency, and presenting a shrivelled appearance. This means of diagnosis would only apply to scalds from water. A scald from melted lead could not be distinguished from a burn produced by a solid heated to the same temperature.

Action of melted metals.—A singular case in which an attempt on life was made by pouring a melted metal into the ear, occurred to M. Boys de Loury. The mother of an idiot, aged twenty-five, wishing to get rid of him, adopted the plan of pouring melted pewter into his right ear while he was lying asleep. Great pain and violent inflammation followed, but the young man recovered. The mother then alleged that he had himself poured the melted metal into his ear. At a judicial investigation, M. Boys de Loury was required to say whether such an act was likely to occasion death, and if so, how it happened that the party had in this instance recovered. The alloy was formed of seven parts of tin and three of lead, and the melting point of such an alloy would be about 340°. M. De Loury stated that such an act might lead to death by causing inflammation and caries of the internal ear extending to the brain. The recovery of the youth was owing to the mischief which followed having been comparatively slight. In performing some experiments on the dead body, he found that it was difficult to fill the ear-passage with such an alloy, in consequence of the sudden expansion of the air caused by the high temperature. (Ann. d'Hyg. 1847, ii. 424.)

Some of the oils boil at 500°, and produce, by contact with the skin, burns as severe as those caused by melted metals.

Various degrees of burns.—Dupuytren has divided burns into six degrees, which are commonly recognised by medical jurists.

1. The heat produces a simple inflammation of the skin without vesication. The skin is very red, but the redness disappears on pressure: there is slight and superficial swelling, with severe pain, relieved by the contact of cold substances. The inflammation subsides after a few hours, and the skin resumes its natural condition;—or it may continue for several days, and the cuticle then peels off.

2. There is a severe inflammation of the skin, and the cuticle is raised into blisters containing a yellow-coloured serum. This kind of injury is generally the result of the action of boiling liquids. The blisters are commonly formed *immediately;* and others are produced during a period of twenty-four hours, or those which are already formed become enlarged. Suppuration takes place if the cuticle be removed, and the individual survive for a period sufficiently long. As the cutis or true skin is not destroyed by this degree of burn, there is no mark or cicatrix to indicate its past existence.

3. The superficial part of the cutis is destroyed. The burn appears in the form of yellow or brown patches, insensible when gently touched, but giving pain when strongly pressed. An inflammatory redness, accompanied by vesication, is perceived in the healthy portion of skin around the eschars. A white and shining cicatrix, without contraction of parts, remains after healing. This degree of injury is commonly observed in burns from gunpowder, and the part which was the seat of the burn is frequently stained black, when the particles of gunpowder have not been removed soon after the accident.

4. The skin is disorganized as far as the subcutaneous cellular tissue. There are firm and thick eschars, which are quite insensible. If the burn has arisen from a boiling liquid, the eschars are soft and of a yellowish colour; if from a red-hot solid, they are firm, hard, of a brown colour—sometimes black. The skin around appears shrivelled and puckered up towards the eschar, which is depressed below the cutaneous surface. The surrounding integuments present a high degree of inflammation, and vesications appear. From the fourth to the sixth day, the eschar falls off, leaving an ulcerated surface which heals slowly, and is always indicated by a cicatrix.

5. In the fifth degree, the whole of the layers of the skin, the cellular membrane, and a portion of the muscles beneath, are converted into an eschar. The appearances are similar to those of the fourth degree, but in a more aggravated form.

6. The burnt part is completely carbonized. If the individual survives, the most violent inflammation is set up in the subjacent tissues and organs.

Danger to life.—Neither a burn nor a scald appears to be considered as a *wound* in law, but in the statute of wounding, they are included among bodily injuries dangerous to life. (1 Vic. 85, sec. ii.) Burns and scalds are dangerous to life in proportion to the extent of surface which they cover, as well as the depth to which they extend. The extent of surface involved in a superficial burn is of greater moment than the entire destruction of a small part of the body through an intensely heated solid. When the burn is extensive, death may ensue either from the intensity of the pain produced, or from a sympathetic shock to the nervous system. Death takes place rapidly from burns in children and nervous females; but in adults and old persons, there is a better chance of recovery. When death has been caused by intense pain, no post-mortem changes have been detected; but under other circumstances, it has been found, on inspection, that there were patches of redness on the bronchial mucous membrane, as well as on that of the alimentary canal. The brain has been found gorged, and the ventricles have contained an abundance of serosity. The serous liquids of the pericardium and pleura have also been in larger quantity than natural. In short, besides congestion, there is generally abundant serous effusion in one of the three great cavities, especially in the cranium. This arises from the sudden reflux of blood into the interior. (See cases by Mr. Long, Med. Gaz. xxv. 743; also by Mr. Erichsen, xxxi. 551.) If the person survive the first effects, he may die from inflammation, suppuration, gangrene, irritation, fever, or he may be worn out by exhaustion. In this respect, burns of the 4th, 5th, and 6th degrees are especially dangerous to life; and it would be unsafe to give an early prognosis, as inflammation of deep-seated viscera only appears after seven days.

Stupor from burns.—In some instances, especially in children, stupor and insensibility have supervened, owing to a sympathy with the brain; and these symptoms have been followed by coma and death. If, under these circumstances, opium has been given to the patient as a sedative, the stupor resulting from the burn may be attributed to the effects of the drug; and should the person die, the practitioner may find himself involved in a charge of malapraxis. It may be alleged, as in the following case related by Mr. Abernethy, that the person was poisoned by opium. A medical man was charged with the manslaughter of a child by giving to it an overdose of opium, when it was labouring under the effects of a severe scald. Mr. Abernethy stated in his evidence, which was given in favour of the practitioner, that he thought the exhibition of opium very proper;—that the quantity given, eight drops of tincture of opium immediately after the accident, and ten drops two hours afterwards, was not an overdose for a child (the age is not stated.) The circumstance of the child continuing to sleep until it died, after the exhibition of the opium, was no proof that it had been poisoned. This sleep was nothing more than the torpor into which it had been plunged by the accident. The surgeon was acquitted. Notwithstanding the favourable opinion expressed of this plan of treatment, it would be advisable to avoid the use of opium on these occasions, in respect to infants and young children. Life is readily destroyed in young subjects by the smallest doses of this drug; and there are no satisfactory means of distinguishing the comatose symptoms produced by a burn or scald, from those produced by an overdose of opium.

Did the burning take place before or after death? Vesication.—The production of *vesication* or of *blisters* containing serum, is commonly regarded as an essential character of a burn which has been produced during life. Vesication is especially seen in scalds, or in those cases in which the skin has been burnt by flame or by the ignition of the clothes, provided the cuticle be not destroyed. It is not so commonly observed in burns produced by intensely heated solids. In vesication, the cuticle becomes raised from the true skin beneath, and is con-

verted into one or more blisters containing serum, while the skin around is of a deep-red colour. It is very uncertain as to the time at which it appears; it may be produced in a *few minutes*, or sometimes not for several hours: thus, death may take place before vesication occurs; and the non-discovery of this condition does not warrant the opinion that the burn could not have taken place during life. If the cuticle be removed from a vesicated part of the living body, the skin beneath will become intensely reddened; but if the cuticle be stripped off in a dead subject, the skin will become hard, dry, and of a horny-yellow colour; it does not acquire the intense scarlet injection which is acquired by the living skin under the same circumstances.

When *vesication* is met with, is this certain evidence that the burn was vital, *i. e.* that it took place during life? This question is of some importance in legal medicine. The following are, I believe, the facts which have been hitherto ascertained. When boiling-water is poured upon the dead body ten minutes after death, the skin is simply ruffled and shrivelled; but the cuticle does not become raised into a blister. (Christison.) At a longer period than ten minutes, the same effects have been observed while the body retained its warmth. What the effect would be within a shorter period than *ten minutes after death*, it is not possible to say; nor is it likely that any experiments can be easily performed to determine this point. It is not probable, however, that vesication would follow after active life (indicated by the continuance of the functions of respiration and circulation) had ceased, except under circumstances to be presently stated. Dr. Christison, on one occasion, had an opportunity of trying the experiment on the same subject before and after death; this was in the case of a young man who had poisoned himself with opium. While he was lying in a hopeless state of coma, four hours before death, a hot iron was held on the outside of the hip-joint; and half an hour after death, a red-hot poker was applied to three places on the inside of the arm. Vesication followed the burns in both instances; but those caused during life contained serum, and those formed after death, *air*. In another experiment, a cauterizing iron produced no blisters on a leg, half an hour after amputation; but vesications, containing air, were formed, when in another case the iron was applied ten minutes after amputation. On the whole, Dr. Christison thinks that a vesication containing serum, indicates a vital, and one containing air, a post-mortem burn. I have performed many experiments on the bodies of infants eighteen and twenty hours after death, both with boiling water and heated solids; but in no case have I observed any kind of vesication to follow at that period. The skin became shrivelled, and was partly destroyed by the heat, but there were no blisters produced. (See case by M. Ollivier, Ann. d'Hyg. 1843, i. 383.) It has been ascertained, that under certain morbid states of the body, blisters containing serum may be produced in the dead subject, even twenty-four hours after death. M. Leuret observed, that this took place in an anasarcous subject, in the vicinity of which a heated brazier had been placed. The cuticle became hardened, then raised and blistered; and the blister contained an abundance of reddish-coloured serum. In repeating this experiment on other dead bodies not infiltrated, it was observed that no vesications containing serum were produced. (Ann. d'Hyg. 1835, ii. 387.) M. Champouillon has recently repeated the experiments of M. Leuret on anasarcous bodies, and he finds that blisters may be produced in these cases at almost any period after death. Thus, they occurred when heat was applied to the anasarcous subject recently dead,—to another when in a state of cadaverous rigidity, and to a third when putrefaction had commenced. The blisters do not appear immediately,—the time which he found requisite for their production varied from two to six hours. The serum effused beneath the raised cuticle was rarely tinged with blood. (Ann. d'Hyg. 1846, i. 421.) These experiments only confirm the results obtained by M. Leuret; they add nothing to our knowledge of the subject. The conclusion to be drawn from them is, that in the examination of burns on the body of a

person affected with anasarca, it is necessary to be cautious in expressing an opinion. In such cases it would not be possible, from the existence of mere vesication, to say whether the burn took place before or after death.

Dr. Wright, of Birmingham, has lately published the results of some experiments on post-mortem burning, from which he infers that the production of a *serous* blister in a dead body is not dependent on the presence of serum in the cellular tissue (anasarca,) but upon the amount of (latent) organic life remaining in the body. He states that he has produced a serous blister post mortem more than a dozen times,—twice within half an hour, and once within fifteen minutes after death; and in amputated limbs he has produced them in from half a minute to four minutes and a half after amputation. The only favourable opportunity which occurred to him for producing, post mortem, a serous blister, was in the person of a female thirty years of age, who died suffocated from acute congestion of the lungs. She was slightly anasarcous. *Three hours and a half* after death, when the body was quite warm, and the joints flexible, a spirit-lamp-flame was applied to the lower and back part of the left leg. After the lapse of an hour, blisters had arisen filled with serum of a pale straw colour; one contained two and the other three drachms.

Ten and fifteen hours after death, when the body had become cold and rigid, the flame produced only *gaseous* blisters. (Pathological Researches on Vital and Post-mortem Burning, 1850.) These results are not in accordance with those obtained by Dr. Christison and M. Champouillon.

A line of redness.—In burns produced by red-hot solids, other effects besides vesication follow. The edge of the skin immediately around the part burnt is commonly of a dead white; and close to this, is a *deep red line*, gradually shaded off into the surrounding skin, which is reddened. The diffused redness is removable by pressure, and disappears with life; the red line here referred to, however, is not removable by pressure, and is persistent after death. This line of redness is not always met with in severe burns; and when the individual survives one or two days, its production appears to depend upon a power of reaction in the system. Thus, then, its absence furnishes no proof of the burn having a post-mortem origin; for it is not a necessary accompaniment of a vital burn. Dr. Christison has endeavoured to determine by experiment whether this line of redness could be produced by applying a heated solid to a dead subject. He found that when the person had been dead only *ten minutes*, no such effect was produced. In repeating his experiments on dead subjects many hours after death, I have found that no line of redness ever presented itself, so that its discovery in a dead body burnt, would appear to indicate either that the burning took place during life, or within ten minutes after death,—most probably the former. M. Champouillon takes exception to the inference derivable from these experiments. He says that he has caused the production of a line of redness by the application of heat to the dead body, and that it is a uniform accompaniment of the formation of blisters in the dead. He admits that it is in this case a mere capillary infiltration, quite superficial, and surrounding the margin of the blister, while in the red line produced during life, the tissues of the skin are deeply injected, and it is evidently the result of vital reaction. (See Ann. d'Hyg. i. 422.) It would appear that he has only remarked this condition in dead anasarcous bodies, in which vesications had been produced, and it is obvious from the description, that he is referring to a slight congestion of the vessels, occasioned probably by the stagnation of the fluid portion of the blood in the superficial capillaries. It is altogether distinct from the line of redness described by Dr. Christison as a frequent consequence of severe burns. In the case of *Mr. Westwood*, who was murdered in June, 1839, the fact of certain burns found on the body having been produced during life, was determined by Mr. J. G. French, from an observance of this sign. The deceased was found dead with his skull extensively fractured, his throat cut, and his body burnt in various places. Mr. French, who gave evidence

on this occasion, remarked, that the burns were surrounded by a line of redness; —that they were probably produced about the same time as the other injuries, but certainly while there was some vital action in the system. When, however, vesication and a line of redness are absent, we have no medical data on which to found an opinion as to whether the burn was caused before or after death. Dr. Wright considers that in a low state of vitality a line of redness might not be produced by a severe burn on the living body, and that more certain reliance may be placed on the red marks found beneath the blisters and crusts of vital burns. These latter have been well marked when he has found the line of redness itself indistinct. (Op. cit. page 25.) These remarks of Dr. Wright were chiefly made in reference to a remarkable case of alleged matricide at Bridgnorth. (*Reg.* v. *Newton*, Shrewsbury Lent and Summer Assizes, 1849.)

When *several burns* are found on a dead body, it may be a question whether they were all produced at the same time. This is a point which can be determined only by observing whether any of them present signs of gangrenous separation:—of suppuration,—granulation, or other changes that take place in a living body after accidents of this kind. The witness may be asked, how long did the deceased survive the burn? A person may die in a few minutes or live some hours after receiving a most extensive burn; and yet there will be no change in the part burnt, to indicate when death actually took place. There may have been no time for inflammation or its consequences to become established. Suppuration generally follows vesication; and in severe cases it may occur on the second or third day; but often not until a later period. In regard to gangrene, this takes place, when the vitality of a part burned is destroyed. The time of its occurrence is uncertain, but it sometimes very speedily follows the accident.

After a murder has been perpetrated, it is not uncommon for a murderer to attempt to dispose of the body by burning it. This was remarked in the case of Mr. Paas, (*King* v. *Cook*,) likewise in the case of The *Queen* v. *Good*, and in another case at Leeds, (Jan. 1843,) where a mutilated body was found floating in a river with marks of burning about it. In general, the body is not burnt until all signs of life have disappeared; we shall therefore meet, in such cases, with nothing but the charring of dead flesh, so that no difficulty can exist in forming an opinion. When the burning is partial, and has probably taken place from a wilful ignition of the clothes, at or about the time of death, some caution is required in expressing an opinion, since marks of vesication and a line of redness are not always present in vital burns. It is by no means unusual, however, to find it stated in evidence, that blisters are a constant accompaniment of a burn in the living body! In the case of The *Queen* v. *Taylor*, (York Lent Assizes, 1842,) the deceased was found dead with marks of strangulation on her neck, and her clothes were much burnt from her waist to the knees. She was lying across the hearth,—the body was much burnt, as well as the upper and lower extremities and the neck: in the opinion of the medical witness, the burn on the neck could not have been produced by the fire extending from the other parts of the body. In cross-examination he stated that the burns must have occurred after death; they could not have taken place before, nor at the time of death, because there was no vesication, and he had never seen a burn on a living person which was not followed by blistering! The prisoner was convicted, the counsel having failed to prove or render it probable that death was caused as alleged by accidental burning.

Wounds caused by fire.—On the discovery of wounds on a body burnt by fire, it is necessary they should be closely examined, in order that a witness may be enabled to say whether they have been caused by cutting or other instruments, *before* death by burning, or whether they are not simple mechanical results of the effect of fire on the skin. Mr. T. B. Curling, of the London Hospital, has communicated to me a case which will show the importance of this inquiry. A

little boy, two years of age, was brought to the London Hospital, Nov. 11th, 1840, so severely burnt on the face, neck, abdomen and extremities, that he survived the accident only three quarters of an hour. It appeared that the stepmother, who had charge of the child, left him at home locked up in a room where there was a fire, while she went out. Some of the neighbours, shortly afterwards hearing screams proceeding from the room, broke open the door, and discovered the child enveloped in flames, and its clothes on fire. The flames were immediately extinguished, and the little boy was brought to the hospital. Suspicion of unfair treatment having been excited by the appearance of wounds about the knees, which were observed as soon as the child was admitted, and by the reported neglect and ill usage of the child by the stepmother, the coroner directed an inspection to be made. The body was plump and well formed. The skin in the burnt parts was denuded of cuticle and converted into a deep yellowish or blackish dry mass, which was very tense, hard, and easily torn. There were gaping wounds on both knees. On the right side, a fissure on the skin commenced about the middle of the thigh, and proceeded for two inches and three quarters to the inside of the patella, where it became somewhat jagged, and making a sudden turn inwards passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh a little above the knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the adipose tissue beneath, which appeared white, and free from all appearance of extravasation of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. The vessels on the surface of the brain were very turgid, and the cortical structure appeared remarkably dark-coloured. The lungs were congested, but the heart contained very little blood. The mucous membrane of the stomach presented a slight pinkish hue, but that of the intestinal canal was nearly white. The follicles throughout the whole of the intestines were all highly developed and very prominent. The mesenteric glands were enlarged. The alimentary canal contained a good deal of undigested food. The liver was in every respect natural. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of the fire, and the irregular character and appearance of the fissures, Mr. Curling concluded that they were not the result of wounds inflicted before the occurrence of the burn: he considered them to have been occasioned by the influence of heat, which had forcibly corrugated the skin and completely destroyed its elasticity, and the superficial layer of adipose tissue being closely adherent to the cutaneous tissue, necessarily gave way at the same time. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the adipose tissue, had not yielded with it. This appearance alone was sufficient to negative the supposition of the infliction of the wounds by cutting instruments. The production of the fissures might have been aided by the child's struggles immediately after the occurrence of the burn, but it did not appear that they were at all violent. The conclusion at which Mr. Curling arrived was quite justified by the facts; and the case is calculated to throw an important light on the accidental origin of fissures or wounds of the skin in cases of death from burns.

Summary.—The conclusions which, it appears to me, we may draw from the foregoing statements, are: 1, that, as a general rule, when we discover marks of vesication, with serous effusion or a line of redness, or both, about a burnt part of the body, we are justified in saying that the burn has occurred during life; 2, that when these appearances are not met with, it by no means follows that the burn was not vital; the affirmative evidence derived from such appearances being much stronger than the negative.

Cause of death.—Whether a burn or a scald was or was not sufficient to account for death, must be determined by the extent, depth, and situation of the injury: but even when the burn has clearly been caused during life, the body should be carefully examined for other marks of violence, as blows about the head, wounds, marks of strangulation, and internally for hemorrhage, disease, or poisoning. It must be remembered, that in burns which are rapidly fatal, the serous liquid found in the cavities has commonly a red colour, and the mucous membranes are also reddened.

The subject of *scalding* scarcely requires a separate notice. A scald from boiling water would, when recent, be indicated by vesication and the sodden state of the skin. The living structures are not charred or disorganized as by the application of a red-hot solid. At the Liverpool Summer Assizes, 1847, a woman was convicted of throwing boiling water over her husband, with intent to murder him. (*Reg.* v. *King.*) In another case (*Reg.* v. *Blewitt*, Worcester Summer Assizes, 1847,) the prisoner was convicted of the manslaughter of his wife by pouring over her the contents of a kettle of boiling water. These are the only recent instances of criminal scalding which are reported.

HUMAN OR SPONTANEOUS COMBUSTION.

Supposing that a dead body is found burnt, and there is no other cause of death about it, it may be said that the burning was neither the result of accident nor of homicide, but that it was the effect of spontaneous or human combustion. There are two opinions concerning this so-called spontaneous destruction of the human body. On the one hand, it is alleged that the combustion may take place from internal causes,—in other words, that the process is literally *spontaneous*: on the other hand, it is contended that the contact of a substance in a state of ignition is necessary for the production of the phenomenon,—so that, according to this view, the human body merely becomes preternaturally combustible. The hypothesis of those who advocate *spontaneous* combustion is, it appears to me, perfectly untenable. So far as I have been enabled to examine this subject, there is not a single well authenticated instance of such an event occurring—in the cases reported which are worthy of any credit, a candle, or some other ignited body, has been at hand, and the accidental ignition of the clothes was highly probable, if not absolutely certain. It is in vain that they who adopt this hypothesis appeal to the electrical state of the atmosphere or of the individual, coupled with the impregnation of the system with the inflammable principles of alcohol, as conditions sufficiently explanatory of their views,—such explanations may be reserved until the occurrence of this spontaneous combustion from internal causes is placed beyond all dispute. [For a full description of the phenomena which are said to accompany this condition, see Casper's Wochenschrift, 1841, Nos. 8, 9, 10; also, Henke's Zeitschrift der S. A. 1842, ii. 228; 1843, ii. 39.]

We have, then, only to consider how far the views of those who allow that the body may acquire preternaturally combustible properties are consistently borne out by facts. It is generally admitted that the human body is highly difficult of combustion; and, therefore, if in any case the degree to which it is consumed by fire is great in proportion to the small quantity of combustible matter destroyed about the person, it is not unreasonable to refer this to its possessing greater combustible properties. This is precisely the species of evidence which is furnished by the alleged cases of spontaneous combustion: the body has been found almost entirely consumed, and the clothes and other articles of furniture surrounding it but little injured. A similar remark was made by Dr. Denman, respecting two cases in which the two husbands were tried for the murder of their wives: in both it was the opinion of this physician, that the bodies of the deceased were preternaturally combustible.

Without attempting to offer any explanation of the fact, there appears to be sufficient evidence on record to bear out the view that the human body may

under certain circumstances, acquire increased combustible properties. At the same time, the medical jurist will perceive that this admission does not involve any difficulty in the judicial determination of a question of murder by burning, since it is contended that the combustion of the body cannot take place except by contact with ignited substances. But whether the ignition of the clothes of a deceased person took place accidentally, or by the criminal act of an accused party, is a totally different question,—it is one in which a medical jurist is no more concerned than a non-professional witness,—this is, in fact, a point which can be cleared up only by general or circumstantial evidence. If it be admitted that the body of one person will burn more rapidly and completely than that of another, this will be no ground of exculpation to a prisoner who is proved to have wilfully set fire to the clothes of that person. It may be urged in defence, that the prisoner might not have intended to destroy the deceased; and that, although he ignited the clothes, he did it without any malicious intention; and that death would not have been caused by his act, but for the preternatural combustibility of the body of the deceased! The intention which a person may have had in setting fire to the clothes of another, when he could not possibly know to what degree the burning would extend, is, of course, a question for a jury, to be decided from the circumstances. The relation of this subject of the alleged spontaneous combustion of the body to medical jurisprudence, appears therefore to have been much exaggerated. The only credible part of the doctrine can never present any sort of difficulty to a medical jurist. In the case of *Stauff*, tried and convicted of the murder of the *Countess of Goerlitz*, the theory of alleged spontaneous combustion of the human body was completely refuted by Liebig and other eminent chemists (see Med. Gaz. xlvi. 899.)

BURNS BY CORROSIVE LIQUIDS.

Among the cases in which medical evidence is sometimes required, are those of throwing sulphuric acid or other corrosive liquids on the person. This crime has been especially prevalent of late years, and until the recent alteration in the criminal law there was no adequate punishment for it. On one occasion, the prisoner escaped the charge of felony, because it could not be considered, in law, that sulphuric acid was capable of producing a *wound*—the man having been indicted for wounding! This case clearly showed a strong necessity for some legal definition of a wound, as well as the uncertainty of medical opinions; for while one surgeon considered that the injury produced was a wound, another thought that it was not. The judges decided that it was not a wound within the meaning of the statute. (*The King* v. *Murrow*, Liverpool Aut. Assizes, 1835.) The Act 1 Vic. c. 85, s. v. while it punishes the offence, omits all reference to a definition of the word wound. The nature of the liquid thrown is merely defined in general terms to be "any corrosive fluid or other destructive matter"—a point which will require to be settled by medical evidence. In common language, and according to the statute, the injury thus produced is called a burn; but it is wholly different in its origin, as well as in its progress. I do not know that there has been a single instance in which such an injury has directly destroyed life; but great deformity and actual blindness have resulted. A medical man is sometimes required to distinguish these injuries from burns and scalds:—this may be easily done in the first instance, by the appearance of the part injured, as well as by the description of the first symptoms. The stain is brown when sulphuric acid has been used, and yellow when nitric or muriatic acid has been employed. The eschar is soft, and not dry, as in a burn from a heated solid. The skin touched by a concentrated acid is destroyed and sloughs away, leaving a suppurating and granulating surface. The period of recovery will depend on the extent of the injury. Although a person may not die from the direct effects of the acid, yet in certain irritable constitutions the inflammation which follows in deep-seated parts might prove fatal. In infants, or delicate nervous females, an

extensive injury thus produced may readily destroy life. In the case of *Miss Cashin*, for whom an escharotic liniment was prescribed by a quack, there was no doubt that death was caused by the great local mischief produced by the application. The nature of the acid may be determined by applying wetted linen to the part when the injury is recent, and examining the liquid thus absorbed. In general, however, evidence is readily obtained by examining the spots or stains left on articles of clothing or furniture. Sulphuric acid is most commonly used; but in a case which occurred at Guy's Hospital, nitric acid had been thrown at the individual, and had led to the destruction of the sight of one eye. The caustic alkalies might also be used under these circumstances, as well as numerous other liquids, on which the only medical opinion required would be, whether the liquid employed should or should not be considered as corrosive or destructive matter. To constitute a felony, it is necessary that the person should have sustained, from the act of throwing, some grievous bodily harm.

The mineral acids are sometimes used in other ways for the destruction of life. In June, 1833, a man poured a quantity of strong nitric acid into the ear of his wife while she was lying asleep. She awoke suddenly with a violent pain in the ear, which continued for three days, whereby she became weak and exhausted. Soon afterwards there was copious hemorrhage, and a portion of membrane escaped. She lost the use of her right arm, and became completely deaf. Suppuration took place from the ear, and blood escaped daily. She gradually sank and died, six weeks after the injury, the right half of the body being convulsed before death. On inspection, a portion of the external ear was wanting, and the ear-passage was much wider than natural. The brain, near the petrous portion of the temporal bone, was softened, and the bone itself carious. The injury had led to death indirectly by producing disease of the brain. (Medical Gazette, xvii. 89.)

INFANTICIDE.

CHAPTER XXXVIII.

NATURE OF THE CRIME—THE SAME EVIDENCE REQUIRED AS IN OTHER CASES OF MURDER—PROOF OF LIFE DEMANDED—BODY OF THE CHILD NOT DISCOVERED—MEDICAL EVIDENCE AT INQUESTS—AGE OR MATURITY OF THE CHILD—VIABILITY NOT REQUIRED TO BE PROVED—CHARACTERS FROM THE SIXTH TO THE NINTH MONTH—SIGNS OF MATURITY—ABNORMAL DEVIATIONS—POSITION OF THE UMBILICAL OPENING—GENERAL CONCLUSIONS—RULES FOR INSPECTING THE BODY.

Nature of the crime.—By infanticide we are to understand, in medical jurisprudence, the murder of a *new-born* child. The English law, however, does not regard child-murder as a specific crime; it is treated like any other case of murder, and is tried by those rules of evidence which are admitted in cases of felonious homicide. In saying that infanticide is the term applied to the murder of a *new-born* child, it is not thereby implied that the wilful killing should take place within any particular period after birth. Provided the child be actually born and its body entirely in the world, it matters not whether it has been destroyed within a few minutes, or not until several days after its birth. In the greater number of cases of infanticide, however, we find that the murder is commonly perpetrated within a few hours after the birth of the child. Although the law of England treats a case of infanticide as one of ordinary murder, yet there is a particular difference in the medical evidence required to establish the murder of a new-born child. It is well known that in the course of nature, many children come into the world dead, and that others die from various causes soon after birth.—In the latter, the signs of their having lived are frequently indistinct. Hence, to provide against the danger of erroneous accusations, the law humanely presumes that every new-born child has been born dead, until the contrary appear from medical or other evidence. The onus of proof is thereby thrown on the prosecution; and no evidence imputing murder can be received unless it be made certain by medical or other facts, that the child survived its birth, and was actually living when the violence was offered to it. Hence there is a most difficult duty cast upon a medical witness on these occasions.

[In the United States, the laws of the various states do not differ greatly from each other; and by all of them, as by that of England, proof of the murder must be furnished to constitute the crime of infanticide. In Pennsylvania, sec. xviii. of Act of 22d April, 1794, provides that the "concealment of the death of any such child shall not be conclusive evidence to convict the party indicted for the murder of her child, unless the circumstances attending it be such as shall satisfy the mind of the jury that she did wilfully and maliciously destroy and take away the life of such child." The concealment of the birth of a bastard child, whether it was born alive or dead, is punishable by fine or imprisonment. A conviction for a second offence is punishable by imprisonment for life.

In most of the other states, this crime is in like manner punishable by fine imprisonment, or both.

In Louisiana, the penal code recognises infanticide as a specific crime, of the same grade as murder. See last Am. ed. of this work by Dr. G.—H.]

Body of the child not discovered.—In cases of child-murder, medical evidence is commonly founded upon an examination of the body of the child; but it must be borne in mind, that a woman may be found guilty of the crime although the body of the child be not discovered:—it may have been destroyed by burning or otherwise disposed of, and a medical witness may have only a few calcined bones to examine. (Ann. d'Hyg. 1845, ii. 129.) In these cases of the non-production of the body, good legal evidence of the murder would, however, be demanded; and this evidence should be such as would satisfactorily establish the matter of fact before a jury. The production of the body of a child is therefore no more necessary to conviction than in any other case of murder. A woman has been tried within the last few years for the murder of her child, the body of which was never discovered.

[This seems to us very unwarrantable practice. According to Roscoe's Criminal Evidence, (4th American edition, Sharswood, 693,) "The corpus delicti that a murder had been committed by some one is essentially necessary to be proved, and Lord Hale advises that in no case should a prisoner be convicted when the dead body has not been found—when the fact of the murder depends upon the fact of disappearance." Ante, p. 18. (Tyner *v.* The State, 5 Humphreys, 383.)

"A girl was indicted for the murder of her child, aged sixteen days. She was proceeding from Bristol to Llandago, and she was seen near Tintern with a child in her arms at six o'clock in the evening: she arrived at Llandago between eight and nine without the child. The body of a child was afterwards found in the Wye, near Tintern, which appeared not to be the child of the prisoner. Lord Abinger, C. B., held that the prisoner must be acquitted, and that she could not [694] by law either be called upon to account for her child, or to say where it was, unless there was evidence to show that the child was actually dead." Hopkins' case, 8 C. & P. 591, also Id. xxxiv. 540.—H.]

Medical evidence at inquests.—In most instances, however, the body of the child is found,—an inquest is held, and medical evidence is demanded. In giving evidence at a coroner's inquest on a case of infanticide, as much care should be taken by a practitioner as if he were delivering it before a judge at the assizes. Some witnesses are disposed to treat an inquest with indifference, and to be careless in their evidence, thinking probably that, should the case come to trial, they could prepare themselves and amend any statements which from subsequent reflection might appear to have been hastily made before a coroner. But it ought to be known that the depositions taken by this officer are at the trial placed in the hands of the judge as well as of the prisoner's counsel; and should a witness deviate in his evidence at the assizes from that which he gave at the inquest,—or should he attempt to amend or explain any of the statements then made, so that they might, by the ingenuity of a barrister, be represented as having a new bearing on the prisoner's case, he would expose himself not merely to a severe cross-examination, but probably to the censure of the Court. If medical men were to reflect that in delivering their opinions before a coroner and jury, they are, in many instances, virtually delivering them before a Superior Court, it is certain that many unfortunate exposures would be easily avoided.

UTERINE AGE OR MATURITY OF THE CHILD.

One of the first questions which a witness has to consider in a case of alleged child-murder, is that which relates to the age or probable degree of maturity which the deceased child may have attained in utero. The reason for making this inquiry is, that the chances of natural death, in all new-born children, are great

in proportion to their immaturity; and that, supposing them to have survived birth, the signs of their having respired are commonly very obscure. It is found that the greater number of children which are the subjects of these investigations have reached the eighth or ninth month of gestation; yet charges of murder might be extended to the wilful destruction of children at the seventh month or under, provided the evidence of life after birth was clear and satisfactory.

Proof of viability not required.—The English law does not act on the principle that a child, in order to become the subject of a charge of murder, should be born *viable*, i. e. with a capacity to live. It is observed by Mr. Chitty, although no authority is quoted for the statement, that "the object of the law is to prevent injuries to infants having capacity to maintain a separate existence;" and he further suggests that such a capacity should be proved, in order to complete the offence of infanticide. (Med. Jur. i. 411.) This argument, carried to its full extent, would render it no offence to put to death all persons afflicted with any mortal disease. I have been unable to find, in the numerous reported trials for infanticide, any ground for this extraordinary doctrine. The capacity of a child continuing to live has never been put as a medical question in a case of alleged child-murder; and it is pretty certain, that if a want of capacity to live were actually proved, this would not render the party destroying it irresponsible for the offence. Children may be born alive at the sixth or seventh month; but because they are much less likely to survive than those born at the eighth or ninth month, this is not a sufficient ground of exculpation to any person who wilfully destroys them. The real question, as we shall presently see, does not refer to the period of gestation at which a child may be born, but to the fact of its being *living* and *entirely born* when the murderous violence is offered to it. The French law, although it requires in some cases proof of viability in relation to the rights of inheritance, demands only proof of life after birth in reference to a charge of infanticide. (Briand, Man. Complet de Méd. Lég. 201.)

Although the doctrine of viability is not recognised in English jurisprudence, yet in a case which occurred in October, 1836, a coroner refused to hold an inquest on the body of a child, because it had not reached an age (seven months,) at which children are commonly born alive! In this case there was probably no harm done; but when we consider—1st, the great difficulty of determining on the exact age of a child from the characters found on its body; and 2d, that many children born under the seventh month have not only been born alive, but have lived to adult age, the acting on a principle of this kind would be likely to give rise to dangerous abuses. It is impossible to admit that children are to be destroyed with impunity because they happen to be born under the seventh month, or that a child should be assumed to have been born dead, and any inquiry into the cause of death dispensed with, unless it can be medically established that it has passed the seventh month of gestation.

According to one medico-legal authority—if it can be proved that the child which is the subject of investigation has not attained this age (the seventh month,) no charge of infanticide *can* or *ought* to be entertained. Are we to understand by this, that children proved to have been born living before the seventh month, may be wilfully destroyed, and the law take no cognizance of the matter? If this be not the meaning, the statement amounts to nothing, because whether the child have reached the seventh, eighth, or ninth month, life and live birth must still be proved, before the question of murder can be entertained. I have known an instance of a child born between the sixth and seventh months living a fortnight; and many similar cases are recorded. On the doctrine above laid down, the deliberate destruction of such children, although actually living, ought not to be considered or treated as murder! It is satisfactory to know that such a principle as this is not recognised by the law of England. In the case of *Reg.* v. *West* (Nottingham Lent Assizes, 1848,) a midwife was tried on a charge of causing the death of a child under the seventh month of uterine

life (in the perpetration of abortion,) not by any direct violence applied to its body, but merely by leading to its premature birth. ' This case proves, therefore, that a charge of infanticide may be fairly entertained with respect to children *under* the seventh month. The female in this instance was alleged to have been between the fifth and sixth month of pregnancy. The proof of this did not, however, prevent an indictment for murder, or a full investigation of the facts of the case. We also learn from it, contrary to the suggestion of Mr. Chitty, (*supra*) that the *viability* of a child is not by the English law required to be proved on an indictment for child-murder. This child was certainly from mere immaturity incapable of maintaining a separate existence, and it was, therefore, *not viable;* but the judge who tried the case, in answer to an objection taken by prisoner's counsel, said that if the child was proved to have died under the circumstances alleged for the prosecution, it would be murder.

Characters from the sixth to the ninth month.—The following are the characters whereby we may judge of the uterine age of a child from the *sixth* to the *ninth* month of gestation, a period which may be considered to comprise all cases of child-murder. Between the *sixth* and *seventh:*—The child measures, from the vertex to the sole of the foot, from ten to twelve inches, and weighs from one to three pounds. The head is large in proportion to the trunk,—the eyelids are adherent, and the pupils are closed by the membranæ pupillares. The skin is of a reddish colour, and the nails are slightly formed;—the hair loses the silvery lustre which it previously possessed, and becomes darker. Ossification proceeds rapidly in the sternum, and in the bones of the tarsus. The brain continues smooth on its surface:—there is no appearance of convolutions. In the male the testicles will be found in the abdominal cavity, lying upon the psoæ muscles immediately below the kidneys. Between the *seventh* and the *eighth* month:—The child now measures between thirteen and fourteen inches in length, and weighs from three to four pounds. The skin is thick, of a more decidedly fibrous structure, and covered with a white unctuous matter, which now for the first time appears. Fat is deposited in the cellular tissue, whereby the body becomes round and plump:—the skin, previously to this, is of a reddish colour, and commonly more or less shrivelled. The nails, which are somewhat firm, do not quite reach to the extremities of the fingers. The hair becomes long, thick, and coloured. Ossification advances throughout the skeleton. Valvulæ conniventes appear in the small intestines, and meconium is found occupying the cæcum and colon. The testicles in the male are considered about this period to commence their descent, or rather, the child's head being downwards, their ascent towards the scrotum. The time at which these organs change their situation is probably subject to variation. According to J. Hunter, the testicles are situated in the abdomen at the seventh, and in the scrotum at the ninth month. Burns believes that at the eighth month they will commonly be found in the inguinal canals. The observation of the position of these organs in a new-born male child is of considerable importance in relation to maturity, and it may have an influence on questions of legitimacy as well as of child-murder. Mr. Curling thus describes their change of position:—At different periods between the fifth and sixth months of fœtal existence, or sometimes later, the testicle begins to move from its situation near the kidney towards the abdominal ring, which it usually reaches about the *seventh* month. During the eighth month it generally traverses the inguinal canal, and by the end of the ninth arrives at the bottom of the scrotum, in which situation it is commonly found at birth. (Diseases of the Testis, 32.) Its absence from the scrotum does not necessarily indicate that the child is immature, because the organ sometimes does not reach the scrotum until after birth.

Between the *eighth* and *ninth* month, the child is from fifteen to sixteen inches in length, and weighs from four to five pounds. The eyelids are no longer adherent, and the membranæ pupillares will have disappeared. The quantity of fat deposited beneath the skin is increased, and the hair and nails are well deve-

loped. The surface of the brain is grooved or fissured, but presents no regular convolutions; and the cineritious matter is not yet apparent. The meconium occupies almost entirely the large intestines, and the gall-bladder contains some traces of a liquid resembling bile. The testicles in the male may be found occupying some part of the inguinal canal, or they may be in the scrotum. The left testicle is sometimes in the scrotum, while the right is situated about the external ring.

Signs of maturity.—At the ninth month the average length of the body is about eighteen inches, and its weight about six pounds, or between that and seven pounds: the male child is generally rather longer, and weighs rather more than the female. Extraordinary deviations in length and weight are occasionally met with. Mr. Owens, of Ludlow, has reported a case in which the child at delivery measured twenty-four inches, and weighed seventeen pounds twelve ounces. (Lancet, December, 1838.) In a case which I had to examine in June, 1842, the child, a male, measured twenty-two inches, and weighed twelve pounds and a half. [According to Dewees the average weight of the mature fœtus in the United States is rather over seven pounds.—Vide Beck, i. 337.—H.] (For some practical remarks on this subject, by Dr. Ellsässer, see Henke's Zeitschrift, 1841, ii. 235.) At the full period, the head of the child is large, and forms nearly one-fourth of the whole length of the body. The cellular tissue is filled with fat, so as to give considerable plumpness to the whole form, while the limbs are firm, hard, and rounded. The skin is pale. The hair is thick, long, and somewhat abundant. The nails are fully developed, and reach to the ends of the fingers;—an appearance, however, which may be sometimes simulated in a premature child, by the shrinking of the skin after death. The testicles in the male are generally within the scrotum. Ossification will be found to have advanced considerably throughout the skeleton. (See, in relation to the progress of ossification, some remarks by M. Ollivier, Ann. d'Hyg. 1842, 343.) The surface of the brain presents convolutions, and the cineritious matter begins to show itself. The internal organs, principally those of the chest, undergo very marked changes, if the act of respiration have been performed by the child before, during, or after its birth.

The relative position of the point at which the *umbilical cord* is inserted into the abdomen, has been considered by some medical jurists to furnish evidence of the degree of maturity. Chaussier thought that in the mature child, at the ninth month, the point of insertion of the cord exactly corresponded to the centre of the length of its body. Later observations, however, have shown that this is not quite correct. Out of five hundred children examined by M. Moreau, at the Maternité, in Paris, the umbilical aperture corresponded to the centre of the body in *four* only. In the majority of these cases, the point of insertion was eight or nine lines below the centre: among many cases of mature children which I have had an opportunity of examining, the umbilical aperture has generally been situated from a quarter to half an inch below the centre of the body. (Guy's Hosp. Rep., April, 1842.) M. Moreau found, on the other hand, that in some children, born about the sixth or eighth month, the cord was inserted at the middle point of the length. (Lanc. Franç. 1837.) On the whole, it will be perceived that no value can be attached to the situation of the umbilical opening, as a sign of maturity or immaturity.

The characters which have been here described as belonging to a child at the different stages of gestation, must be regarded as an average statement. They are, it is well known, open to numerous exceptions; for some children at the ninth month are but little more developed than others at the seventh; although the converse of this proposition is not true—*i. e.* we do not find that children of the seventh month have undergone such premature development as to be mistaken for children at the ninth month. Twins are generally less developed than single children;—the average weight of a twin child is not more than five pounds, and

very often below this. The safest rule to follow, in endeavouring to determine the uterine age of a child, is to rely upon a majority of the characters which it presents. That child only can be regarded as *mature*, which presents the greater number of the characters already described, and which are met with in children at or about the ninth month of gestation.

If the age of the child has been determined;—whether it be under or over the seventh month, the same rules for a further investigation will be demanded. Should the child be under the seventh month, the medical presumption will be, that it was born dead; but if it has arrived at its full period, then the presumption is, that it was born alive.

Conclusions.—The following may be taken as a summary of the principal facts upon which our opinion respecting the uterine age of the child may be based:—

1. At *six months.*—Length, from nine to ten inches; weight, one to two pounds; eyelids agglutinated; pupils closed by membranæ pupillares; testicles not apparent in the male.

2. At *seven months.*—Length, from thirteen to fourteen inches; weight, three to four pounds; eyelids not adherent; membranæ pupillares disappearing; nails imperfectly developed; testicles not apparent in the male.

3. At *eight months.*—Length, from fourteen to sixteen inches; weight, from four to five pounds; membranæ pupillares absent; nails perfectly developed, and reaching to the ends of the fingers; testicles in the inguinal canal.

4. At *nine months.*—Length, from sixteen to twenty-one inches; weight, from five to nine pounds; membranæ pupillares absent; head well covered with fine hair; testicles in the scrotum; skin pale; features perfect—these and the body are *well developed*, even when the length and weight of the child are much less than those above assigned.

5. The point of insertion of the umbilical cord, with respect to the length of the body, affords no certain evidence of the degree of maturity.

Inspection of the body.—The questions which a medical jurist has to solve, in examining the body of a new-born child, are—

1. To determine its age, or the stage of uterine life which it has reached;—2. Whether it has lived to breathe;—3. Whether it has been born alive;—4. The period of time which has elapsed since its death;—5. The cause of death, whether violent or natural.

Hence, before commencing the inspection—

1. The length (measured from the vertex to the sole of the foot) and weight of the body should be taken;—2. The presence or absence of external fœtal peculiarities noticed;—3. Any peculiar marks or indications of deformity, whereby identity may be sometimes established;—4. All marks of violence in the shape of wounds, bruises, or lacerations, and the kind of instrument or weapon by which they were probably produced;—5. Whether the umbilical cord has been cut and tied, or lacerated; the appearance of the divided vessels, and the length of that portion which is still attached to the body of the child;—6. The presence or absence of vernix caseosa about the groins, arm-pits, or neck—the presence of this substance proves that the child has not been washed or attended to;—7. It will be necessary to state whether there be about the body any marks of putrefaction, indicated by the separation of the cuticle, change of colour in the skin, or offensive odour. It is obvious, that unless these circumstances be noticed before the inspection is commenced, they may be entirely lost as evidence. Notes should be made on the spot, and the original retained, even if copies be subsequently made.

CHAPTER XXXIX.

ON THE PROOFS OF A CHILD HAVING LIVED AT ITS BIRTH—EVIDENCE OF LIFE BEFORE RESPIRATION—SIGNS OF PUTREFACTION IN UTERO—EVIDENCE FROM MARKS OF VIOLENCE—SUMMARY—EVIDENCE OF LIFE AFTER RESPIRATION—INSPECTION OF THE BODY—COLOUR, VOLUME, CONSISTENCY AND ABSOLUTE WEIGHT OF THE LUNGS—STATIC TEST—WEIGHT INCREASED BY RESPIRATION—TEST OF PLOUCQUET—BLOOD IN THE PULMONARY VESSELS—RELATIVE PROPORTION OF FAT IN THE LUNGS—SPECIFIC GRAVITY OF THE LUNGS—GENERAL CONCLUSIONS.

On the proofs of a child having lived at its birth.—The question whether a child was or was not *born alive*, is of the greatest importance in a case of alleged child murder; and it is unfortunately one which, in respect to the proofs upon which medical evidence is commonly founded, has given rise to considerable controversy. When it is stated that in most cases of alleged infanticide which end in acquittals in spite of the strongest moral presumptions of guilt, the proof fails on this point only, it must be obvious that this question specially claims the attention of a medical jurist. The medical evidence of a child having been alive, when violence was offered to it at its birth or afterwards, may be divided into two parts: 1, that which is obtainable before the act of respiration is performed; and 2, that which is obtainable afterwards. At present it will be proper to confine our attention to the question, whether the child was *alive* when it was maltreated,—the fact of its having been *born* alive will be a matter for future consideration. These two questions have been frequently but improperly associated, thus rendering the subject confused; but it must be so obvious as scarcely to require stating, that violence of a murderous kind may be offered to a living child *before* it is entirely born; and that owing to this violence it may come into the world dead.

EVIDENCE OF LIFE BEFORE RESPIRATION.

It was formerly supposed, that if the lungs contained no air, the child could not have respired, and that it must have been born dead. But neither of these views is correct:—children have been known to respire faintly, and continue in existence many hours, without visibly distending the cells of the lungs with air,—the absence of air from the lungs, therefore, furnishes no proof either that respiration has not been performed, or that the child has not lived. (G. H. Rep., April, 1842.) That our law authorities will admit evidence of life in a child before the establishment of respiration, is clear from the decision of Judge Parke, in the case of *Rex* v. *Brain*, in which he said that a child might be born alive, and not breathe for some time after its birth, (Archbold, Crim. Plead. 367,) as also from the charge of Mr. Justice Coltman, in the case of *Rex* v. *Sellis* (Norf. Spr. Circ. 1837.) In this instance it was alleged that the prisoner had murdered her child by cutting off its head. The judge told the jury, that if the child were alive at the time of the act, it was not necessary, in order to constitute murder, that it should have breathed. In fact, it would appear that respiration is regarded as only *one* proof of life; and the law will, therefore, receive any other kind of evidence which may satisfactorily show that the child has lived, and make up for the proof commonly derived from the state of the lungs. It will be first incumbent on a medical practitioner to prove that the child under examination has recently died, or in other words, that there are good grounds for believing it to have been *recently living*. Hence, if the body be highly putrefied, either from the child having died in the uterus some time before birth, or from its having been born and its body not discovered until putrefaction had

far advanced, both internally and externally, the case is utterly hopeless. The medical witness will in general be compelled to abandon the investigation, because the body can furnish no evidence whatever of life after birth. The examination of the thoracic organs would throw no light on the case, for here we are assuming that the lungs are in their fœtal condition.

Signs of putrefaction in utero.—The phenomena of putrefaction in air require no notice in this place; but the changes which ensue when a child dies and is retained within the uterus, may be briefly adverted to, because they may sometimes form a subject for judicial inquiry. According to Devergie, when a child dies in utero, putrefaction takes place as rapidly as in the open air. (Méd. Lég. i. 526;) but this is extremely doubtful. In an advanced state of *uterine putrefaction*, the body of the child is so flaccid, that when placed on a table it becomes almost flattened by the mere gravitation of its parts. The skin is of a reddish-brown colour, not green as in a putrefied body exposed to air. The cuticle covering the feet and hands is white, and sometimes raised in blisters,—the cellular membrane is filled with a reddish-coloured serum, the bones are moveable, and readily detached from the soft parts. In the opinion of Devergie, the principal difference between uterine and atmospheric putrefaction in the body of a new-born child, is seen in the colour assumed by the skin:—but it must be remembered, that should the child remain exposed to the air after its expulsion, the skin may acquire the colour observed in cases of atmospheric putrefaction. The changes which have just been described are such as we may expect to find when the child has been retained in utero eight or ten days after its death. When it has remained for some weeks in the uterine cavity, the body has occasionally been found saponified, or even encrusted with phosphate of lime. If in any case we are able to state distinctly that the body of a child has undergone uterine, and not atmospheric, putrefaction, it is clear that it could not have come into the world alive. Under ordinary putrefaction in air, the child may have been really brought into the world living, and the process may have destroyed every proof of that fact.

Let us suppose that the child died in utero from forty-eight to twenty-four hours before it was born: if it be soon afterwards examined, there will be no marks of putrefaction about it, and the appearances will closely resemble those met with in the body of a child which has been born alive and died without respiring; or of one which may not have been born alive, but have died in the act of birth. It will be impossible to say, in such a case, whether the child came into the world living or dead.

Evidence from marks of violence.—It has been proposed to seek for evidence of life, under these circumstances, by observing the characters presented by marks of violence on the body. In general, when children are murdered, the amount of violence inflicted is considerably greater than that which is required to destroy them, whereby satisfactory proofs of the crime are occasionally obtained. On the other hand, the body of a still-born child, dead from natural causes, is often covered with lividities and ecchymoses;—the fœtal blood does not coagulate with the same firmness as in the adult: hence the evidence derivable from the extent, situation, and characters of marks of violence, is generally of too vague and uncertain a kind to allow of the expression of a medical opinion that the child was certainly living when the violence was offered to it. The characters which have been already described as peculiar to wounds and contusions inflicted during life, may be met with in a child whether it have breathed, or died without respiring. So, again, these characters are open to the exceptions there pointed out; for they will be equally present, supposing the wounds to have been inflicted immediately after the cessation of respiration or circulation in the child, or after the cessation of circulation only,—if the act of respiration have not been performed. Marks of violence on the body of a child which had died in utero twenty-four or forty-eight hours before it was born, would

not present the characters of injuries inflicted on the living. There would be no ecchymosis and no effused coagula of blood. These marks, when they exist, although they may establish that the child was either living or but recently dead at the time they were inflicted, can never show that the child was born alive. Injuries met with on the bodies of children alleged to have been born dead ought, however, to be of such a nature as to be readily explicable on the supposition of their having arisen from accident. If, from their nature, extent, or situation, they be such as to evince a wilful design to injure, it is a fair ground for a jury, —not for a medical witness, to inquire why these extensive wounds, or other marks of violence, were inflicted on a child, if, as it is alleged, it was really born dead. It must be confessed that in such a case there would be a strong moral presumption of murder, although medical proof of life, or actually live birth, might totally fail.

Summary.—As a summary of these remarks, it may be observed, that although physiologically a child may live for a certain period after its birth without respiring,—and legally its destruction during this period would amount to a murder, yet there are at present no satisfactory medical data to enable a witness to express a positive opinion on this point. If other evidence were adduced of a child having lived and been destroyed, under these circumstances,— as where, for example, a woman causes herself to be delivered in a water-bath, or an accomplice covers the mouth of an infant in the act of birth, or immediately after it is born,—a medical witness would be justified in asserting that the absence of the signs of respiration in the lungs was no proof that the child had been born dead. Indeed, it is apparent that the process could not be established, owing to the criminal means actually employed to prevent it. Whether a jury would convict upon such evidence is doubtful; but this is of no importance to the witness:—his statements ought always to be made according to correct and well ascertained principles, and not for the purpose of procuring either the conviction or acquittal of parties accused of offences against the laws. In general, those cases in which questions relative to life before respiration might arise, are stopped in the Coroner's court,—the usual practice being, where the signs of respiration are absent or imperfect, to pronounce that the child was born *dead*. If the lungs sank in water, the presence of marks of violence on the body would be considered as furnishing no evidence;—for the sinking of the lungs would be taken as positive evidence of still-birth, an inference upon which some remarks will be made in speaking of the hydrostatic test. The following case was the subject of a criminal charge at Havre, in 1828:—A woman was delivered of twins. So soon as the first child was born, but not before it had breathed, she killed it by fracturing its skull with a wooden shoe. In a few minutes afterwards the second child was born, but scarcely had its head presented, when she seized it and fractured its skull in the same manner. This double crime was soon discovered. On an examination of the bodies of both children, the same degree of violence was found, presenting in each case precisely similar characters. There could be no doubt, from the appearance of the injuries, that they must have been inflicted on both children at a time when the circulation was going on. In one child, however, it was proved that respiration had taken place; in the other that it had not. In the latter case many practitioners would at once have affirmed that the child had not lived, because there was no proof that it had respired; and they would have proceeded to draw the inference that this could not have been a case of infanticide. Dr. Bellot, however, declared that, although the child had not breathed, he had no doubt that it had been *born alive*, and that it would have lived to respire, but for the violence inflicted. This opinion was chiefly founded upon the similarity in the characters presented by the marks of violence in the two cases. (Annales d'Hygiène, 1832, ii. 199.) See further remarks upon this subject, by M. Ollivier, Ann. d'Hyg. 1843, i. 149; also by M. Devergie, op. cit. 1837, i. 400.

The great question involved in this, and in all similar cases, is the following:—Does the law regard the *prevention of respiration* as murder? There cannot be the slightest medical doubt that living children are often thus destroyed in the act of birth: they die, not from the actual infliction of violence, but because, either through accident or design, the performance of that act which is necessary to maintain existence when the child is born, is prevented. Such a case has not yet been decided, although, from the dicta of the judges, it would probably involve a charge of murder. In a case recently published by Dr. Wharrie, a pregnant woman, thinking she was about to have a motion, sat on an earthen pitcher, two feet in depth, which happened to be full of water. She was there delivered of a child, which fell into the water, and was thus prevented from breathing. The child was full-grown, and its body was free from putrescency. It weighed six pounds, and measured twenty inches. There were no external marks of violence, and the cord had been *tied*. The lungs weighed two and a half ounces; they were of a liver colour, contained no air, and sank in water. The medical opinion was, that from the size and general appearance of the child, and the state of the parts discovered on dissection, it was mature,—that it had never breathed, and life might have been either wilfully or accidentally destroyed. The examiners wisely declined giving the usual opinion from the sinking of the lungs; *i. e.* that the child had been born dead. The woman was not prosecuted, probably on the assumption that the death of the child might have been accidental. As Dr. Wharrie truly observes, there was no medical proof that the child was born alive; although there was a strong moral presumption that life was extinguished after birth. (Ed. Monthly Jour., Oct. 1845, p. 796.)

Dr. Bayard mentions a case, in which a female, under somewhat similar circumstances, was convicted of the murder of her infant, and sentenced to the galleys for five years. In this case there was not the slightest evidence of respiration, but the woman admitted that she fractured the skull of the child, with the intention of destroying it, thinking that she perceived a motion in its legs after it was born. (Ann. d'Hyg. 1847, i. 455.) One physician thought that the child was living when the blows were inflicted; two others, that it was dead. In Dr. Bayard's opinion, the absence of the signs of respiration must be taken as a negative circumstance in favour of the accused.

EVIDENCE OF LIFE AFTER RESPIRATION.

There is no doubt that the proof of the act of respiration furnishes the best and strongest evidence of a child having lived at or about the time it was born. It does not, however, show that a child has been *born alive*. The physical changes in the organs of a child, which result from the establishment of this process, take place in the lungs immediately, but in the heart and its appendages more slowly. It is, therefore, chiefly to the *lungs* that a medical witness looks for the proofs of respiration. Sometimes, however, these organs are found in their fœtal condition, or nearly so;—for although a child may have survived its birth for many hours, there may be no evidence of the fact from the state of the lungs. To such cases, the remarks now about to be made cannot, of course, apply:—the proofs of life must be sought for elsewhere, and if none can be found, the case is beyond the reach of medical evidence. But it is obvious that the occasional occurrence of cases of this description can present no objection to our constantly seeking for proofs of life in the lungs, any more than the fact of poison not being always discovered in a poisoned subject, would be a bar to our seeking for the proofs of poison in every unknown case which presented itself. It is the more necessary to insist upon this point, because some have held, that as we cannot always derive proofs of life from an examination of the lungs of new-born children, we should abandon all evidence of this description, and leave the case in its original obscurity. The very object of medical jurisprudence is, to endeavour to remove these difficulties, and to show, in every department of

the science, the degree to which we may safely trust the medical proofs of crime, however insufficient, inconsistent, or contradictory they may at first sight appear.

Examination of the lungs.—Some have pretended that the fact of respiration having been performed, would be indicated by the *external configuration of the chest.* Thus it is said, before respiration the chest is flattened, while after that process it is arched anteriorly. The diameters of the cavity have also been measured, and certain comparisons instituted, (Daniel,) but these experiments have been attended with no practical result, and have long been abandoned by medical jurists. Admitting that such a visible change of form is occasionally produced by respiration, it is obvious that in these cases, experiments on the lungs may be readily made; and on the results of these, and not upon minute changes in the capacity of the chest, would a medical opinion be based. The cavity of the chest may be conveniently laid open by carrying incisions from below the clavicles downwards on each side from about half the length of the ribs backwards. The diaphragm may be separated from the cartilages without opening the abdomen; the ribs sawn or cut through, and the flap formed by the anterior parietes of the chest, turned upwards. If the child have *not respired,* the following appearances will be seen. The thymus gland, as large as the heart, occupies the upper and middle portions of the cavity;—the heart in its pericardium is situated in the lower and middle portion, and is rather inclined to the left side. The lungs are placed quite in the back part of the chest, so as often to give the impression that they are wanting. In some instances, they project slightly forwards by their anterior margins, but in no instance, unless congested, infiltrated, or otherwise diseased, do they cover and conceal the pericardium. The thymus gland is sometimes of a pale fawn—at others of a deep livid colour: but there is no perceptible difference in this organ in new-born children, before or after the performance of respiration. On the other hand, when the child has *fully respired,* the most striking differences will be observed in the colour and prominence of the lungs. They are of a light red hue, project forwards—appear to fill the cavity of the chest, and cover, and in great part conceal by their anterior margins, the bag of the pericardium. We may meet with every variety in the appearances between these two extremes; for the process of respiration often requires a considerable time in order that it should be *fully* established, especially in those children which are of a weakly constitution or prematurely born. Hence the lungs will be found to occupy their respective cavities to a greater or less extent, and to cover the pericardium more or less, not according to the length of time which a child has lived, but according to the perfection with which the process of respiration has been performed. It will be seen hereafter, that although, as a general rule, the lungs become more perfectly filled with air in proportion to the time which a child survives its birth, yet this is open to numerous exceptions. It will next be necessary to give particular attention to certain other physical characters presented by the lungs.

1. *Colour of the lungs.*—The colour of the lungs *before respiration* is of a bluish red, or deep violet, but it is subject to slight variation. Some medical jurists have compared it to the colour of the spleen. It is important to remark, that a very short exposure to air will materially alter the colour, so that it should be observed and recorded immediately on opening the chest. *After respiration,* the lungs acquire a light red hue, in proportion to the degree in which the process has been performed. If imperfectly established, they will be mottled, generally about the anterior surfaces and margins, the patches of light red being intermixed with the livid fœtal hue, and being slightly raised, as if by distention, above the general surface of the organs. The light red tint changes, after a short exposure to air, to a bright scarlet. This change in the colour of the lungs is not a necessary, nor is it an invariable consequence of a child having lived after its birth. I have known a child to live twenty-four hours respiring feebly, and on examining the body, the colour of the lungs was identical with that of

the organs in the fœtal state. The change of colour is then a usual, but by no means a necessary consequence of the enjoyment of life:—so that the retention of the fœtal colour does not furnish positive evidence of still-birth. Again, the circumstance of the lungs having a light red colour is not an infallible criterion of the child having lived and breathed; for the artificial introduction of air by a tracheal tube, or otherwise, in the attempt to resuscitate a still-born child, is attended with the same physical change. In the course of numerous experiments, purposely made, I have found no appreciable difference. Bernt says, that artificial inflation will not produce a scarlet red tint in the organs, and therefore that this is a criterion of respiration. (Ed. Med. and Surg. Jour. xxvi. 367.) I have not only observed this tint to be absent in respiration, but have actually produced it by artificial inflation in a dead child.

2. *Volume of the lungs.*—The difference in the relative situation of the lungs before and after respiration, has been already described. This difference depends entirely upon the increased volume or dilatation of the organs, arising from the introduction of air. *Before respiration*, the lungs are in general scarcely visible, unless forcibly drawn forwards in the chest. When respiration has been perfectly accomplished, the volume is so much increased that the bag of the pericardium is almost concealed by them. Respiration must, however, have been very perfectly performed in order that this condition should exist to the full extent described; but I have known the lungs to acquire a considerable volume in a healthy and vigorous child in only two or three respirations. The child was destroyed by craniotomy, and died before it was entirely delivered. In other instances a child may live for one or two days, and the volume of the organs be but little altered. Schmitt has remarked that the lungs have sometimes a considerable volume before respiration. I have met with this in more than one instance; but this condition will probably be found in general to depend on disease. As the altered volume of the healthy lungs depends on the introduction of air, the effect is the same, whether the air be derived from respiration, from artificial inflation, or generated by putrefaction. Other circumstances must therefore be considered before we draw any inference from this physical change.

3. *Consistency of the lungs.*—The lungs, *before respiration*, feel like the liver, or any of the other soft organs of the body. They are firm under the finger, but their substance may be lacerated by violent compression. *After respiration* has been fully performed, there is a distinct sensation of what is termed crepitus on compressing them, *i. e.*, air is felt within them. This condition of the organs must, of course, depend on the degree to which respiration has been carried. The lungs of children that have lived for a considerable time after birth will sometimes give no feeling of crepitation under the finger. Generally speaking, lungs of this kind present the other fœtal characters:—thus they are small and of a livid colour. There are, however, cases in which the organs may have the light red colour of respiration, and be actually much dilated in appearance, yet no feeling of crepitus will be perceptible on pressure. This character, therefore, is by no means a necessary accompaniment of the other two. Crepitation furnishes presumptive evidence of respiration; but it may be equally met with in lungs that are putrefied, or which have received air by artificial inflation. The characters here described are seldom found in the lungs of children that have been born prematurely, although these children may have lived some time after birth. They depend on respiration, and in the exceptional cases referred to this process is only very slowly established.

4. *Absolute weight of the lungs. The static test.*—It is generally admitted by medical jurists that the weight of the lungs before respiration is less than that which they have after the establishment of the process. From this an inference has been drawn that the absolute weight of the lungs in an unknown case, compared with certain averages, will aid the inquirer in ascertaining whether respiration has or has not been performed. In order to determine the weight of the

lungs, these organs should be carefully separated by dissection from the heart and thymus gland, and removed, with the trachea and bronchi attached. Previously to their removal, ligatures should be placed on the pulmonary vessels, so that no blood may escape from the lungs. They should now be weighed, and the weight accurately noted in grains. In taking this weight, it does not appear necessary to make any distinction founded on the sex of the child, or on the difference of weight in the two lungs; the only exception would be, perhaps, in relation to twin children imperfectly developed. The average weight *before respiration*, derived from nine cases, was found to be 649 grains. According to Dr. Traill, the weight varies from 430 to 600 grains. It is of importance, in taking the weight of these organs, to be certain that the child is at or near maturity, and that it is of or about the average size and weight: owing to a neglect of this rule, it is highly probable that comparisons have been made of the absolute weight of the lungs in different children, which a full statement of the facts would not have justified. If it be immature or unusually large, the lungs will weigh either less or more than the average. The average weight of the lungs *after respiration*, derived from three cases, was 927 grains; but in making an estimate of this kind much will depend upon the degree to which respiration has been carried. In three cases, in which the children lived half an hour, six hours, and twenty-four hours respectively, the process had been so imperfectly performed that the lungs varied but little in weight from the average before respiration. (G. H. Rep. No. V.) The truth is, we cannot compare the lungs of children, as to weight, according to the *time* which they may have survived birth, but rather according to the *degree* to which the lungs have been penetrated by air. In one instance of alleged infanticide, where the child was probably killed soon after birth, the lungs weighed 1000 grains. In another instance, where the child had certainly lived eight or nine days, the lungs weighed only 861 grains. In the first case, respiration had been perfectly performed; in the second, imperfectly. Hence, to say that the lungs weigh so much *after* respiration, amounts to nothing, unless we can estimate by a sight of the organs its degree; and any calculation founded upon such dissimilar cases must unavoidably lead to error. This increase of weight after birth is commonly ascribed to the altered course of the blood under the establishment of the respiratory process, as well as to the fact that more blood circulates through the lungs after than before respiration. Practically, this view is confirmed by the contraction of the ductus arteriosus, and the simultaneous enlargement of the two pulmonary arteries; changes which have been occasionally observed when the child has survived its birth for only a very short period. As these normal changes in the duct depend on the establishment of respiration, so we cannot expect to find them when the process has been imperfectly performed, although the child may have lived several days.

Weight of the lungs increased by respiration.—It appears to me that the general opinion on this subject is correct, namely, that the healthy lungs of mature new-born children become heavier after respiration, and according to its degree; and where a deviation from this rule is observed, it may probably be explained by the circumstance that the lungs of an immature have been compared with those of a mature child, the lungs of an undeveloped twin with those of one not a twin, or the lungs of one which had breathed imperfectly, with those of another in which respiration had become well established. In this respect the extensive tables drawn up by Lecieux are liable to lead to erroneous inferences relative to the effect of respiration on the absolute weight of the lungs. The weights of the organs are noted, but the *degree* to which respiration had been performed is so loosely stated, as to allow of no fair inference of the effect of this process upon the weight. The time which the children survived is stated; but this, as it is very well known, furnishes no criterion of the degree to which respiration has been carried. Again, we are not informed whether due care was taken to ascertain if the lungs were healthy or diseased. (Considérations sur

l'Infanticide, Paris, 1819.) The following table of the weight of the lungs, in four cases, will show how much the organs are liable to vary in weight after birth, according to the *degree* of respiration.

Case 1.	Case 2.	Case 3.	Case 4.
Born dead.	Lived six hours.	Lived twenty-four hours.	Lived nine days.
Weight, 687 grs.	774 grs.	675 grs.	861 grs.

Relying upon a table of this kind only, without comparing the other characters of the lungs with the weight, it might be inferred that the organs would weigh less in a child which had survived its birth twenty-four hours, than in another which had been born dead, and that there would be very little difference in the weight, whether the child lived six hours or nine days; but when it is stated, that in case 3 the lungs had every fœtal character possessed by those in case 1, and that in case 4 respiration had been obviously very imperfectly performed,—the difficulty is removed. Such cases should rather be compared with the lungs in the fœtal than in the respired state. They merely show what is very well known to, and admitted by, all medical jurists, that there are some instances in which the fact of respiration cannot be determined by the application of the static, or any other test, to the lungs. But this is certainly no valid reason why evidence from this source is to be rejected in all other cases. It may be fairly granted that the weight of the lungs of some children which have outlived delivery, may not come up to the weight assigned to those of children that have breathed; because, as we have seen, children may survive birth many hours without the process of respiration being properly established. On the other hand, as in Chaussier's observations, the lungs of the still-born may be sometimes as heavy as those of children who have respired; but since such lungs would contain no traces of air, the weight above the average in these cases could not be assigned to respiration. Among such subjects, whatever might be the weight of the lungs, if the facts were unknown, it would be impossible to say whether the children were born living or dead. (See Ed. M. and S. J., xxvi. 375.) Increased weight, therefore, is only one among several circumstances to which a medical jurist should attend.

We must not fall into the error of supposing that the lungs increase in weight according to the length of time which a child survives its birth; it is within the limits of a few days, according to the degree of perfection with which a child respires: hence we may meet with cases of children being born alive, surviving some hours or days, and yet after death the lungs will retain the fœtal weight. This is the case in immature subjects, in most twin children, and in those which are mature but weakly. Among many instances that have come to my knowledge, no difficulty of this sort, however, has occurred. The signs of respiration have been sufficiently well developed to justify a medical opinion, although the child had probably not survived its birth above a few hours, or even minutes. (G. H. Rep. April, 1842.) The cases of imperfect respiration, above alluded to, rarely go beyond a coroner's inquest, for want of clear evidence of life. There may be a difference of opinion as to the relative number of instances of perfect and imperfect respiration in new-born children; but a case is never likely to proceed to trial, unless the signs of this process are well marked; and thus many charged with murder must escape, through the want of sufficient medical evidence to establish the fact of respiration and life.

It is scarcely necessary to observe, that the air which the lungs receive by respiration cannot add to their absolute weight. This is because they are in the condition of a bladder which weighs the same, whether it be filled with air or empty. The increase of weight is solely due to the additional quantity of blood, which, owing to the altered course of the circulation, permeates their structure. Hence it follows that when the lungs are distended with air, either from artificial inflation or from putrefaction, the fœtal weight will remain unaltered; and by this means, it is contended, we may distinguish lungs that have respired from those

which have been artificially inflated. Orfila states that the fœtal lungs weigh more before they are artificially inflated, than afterwards,—a circumstance which may depend upon the fact that the impulse employed in inflation may have forced out a portion of blood or other liquid. In carefully performing this experiment, I have found that there was not even the least fractional difference; but that the inflated lungs weighed precisely the same as in the uninflated state. From what has already been said, it follows that *great weight of the lungs can obviously furnish no proof of respiration*, unless this be accompanied by the other physical changes indicative of that process,—as, for example, *great increase in volume from the presence of air and crepitation*. If the lungs be very heavy, and at the same time contain little or no air, it is certain that the increase of weight must depend upon disease or other causes,—not upon respiration. In one case which I had to examine, the lungs were large, and weighed upwards of 1200 grains. They contained no air: when divided into thirty pieces not one portion floated, nor could any air be seen on the closest examination. It was therefore clearly impossible to ascribe a weight so much above the average to the effects of respiration. It must not be forgotten that all the physical characters presented by lungs that have respired are liable to certain fallacies; but, as in the evidence derived from tests used in poisoning, these may be removed, or the force of the objection diminished, by not basing an opinion on one or two conditions only. We must take the whole combined; for it would be as wrong to regard great weight in the lungs *taken alone* as an absolute proof of respiration, as it would be to draw the same inference from a mere change in the colour, volume, or consistency of the organs. This is the view also taken by Professor Orfila. (Méd. Lég. 1848, ii. 229.)

5. *Test of Ploucquet.*—This so-called test for determining whether or not the act of respiration has taken place, was proposed many years since by M. Ploucquet. It is founded on a comparison of the absolute weight of the lungs with the weight of the body of a child. Admitting that the lungs increased in weight from the establishment of the respiratory process, it was supposed that a like difference would take place in the relative weight of these organs to the body; and that the ratios thus procured, compared with certain averages, would enable a medical jurist to determine, in an unknown case, whether or not a child had respired.

Ploucquet conceived that the average ratio of the weight of the lungs to the body in children which had not breathed was 1:70; and in those which had breathed, 2:70 or 1:35. Subsequent researches, however, made by Chaussier and others, have shown that these numbers cannot be considered to represent the true averages. The most serious objection to the employment of this test, in cases of infanticide, is, that the lungs and the body are liable to vary in their relative weights, in children of the same age; and, *à fortiori*, this variation must exist to a greater extent among children which have reached different ages. There may be various degrees of development in the body of a child, without any necessity existing for a corresponding development taking place in the lungs. It is unnecessary to enter into speculations relative to the causes: experience has shown that such variations really exist; and all that a medical jurist has to consider, is whether the differences can be reduced within limits which may make the test available in practice. M. Devergie states, from his experiments, that Ploucquet's test affords no satisfactory results, when applied to the bodies of children which have not reached the eighth month of gestation. According to him, the ratio is for the eighth month:—Before respiration, 1:63. After respiration, 1:37. Ninth month:—Before respiration, 1:60. After respiration, 1:45. The ratio, he observes, becomes higher after respiration, in proportion to the perfection with which the process has been carried on. (Médecine Légale, i. 556. See also Ann. d'Hyg. 1835, i. 485; Med. Gaz., Nov. 1842, p. 208.) The facts which have been collected by different observers appear to me to show that

Ploucquet's test is not fitted to determine, in an unknown case, whether a ch has breathed or not.

6. *Blood in the pulmonary vessels.*—It has been asserted that if blood be fo in the pulmonary vessels of a new-born child, we are justified in assuming th respiration has taken place. On the other hand, the absence of blood from t vessels has been considered to prove that a child has not respired. This cann must have originated in a want of correct observation. The pulmonary ve contain blood, both in the child which has, and in that which has not resp It is possible that the vessels may contain more after respiration than bef but in most cases of infanticide it would be difficult to found any distinction a point of this nature. In examining the bodies of children which have d without respiring, and those of others which have lived and respired for a time after birth, no perceptible difference was found in the quantity of bl existing in these vessels in the two cases. The fact is, the excess of blood a the establishment of respiration is distributed throughout the minute cap system of the lungs: it does not remain in the larger trunks. The state of t pulmonary vessels, therefore, furnishes no evidence of respiration or the con The same observation will apply to the presence of blood in the substance of t lungs. It is said that on cutting through lungs that have breathed the inci are followed by a copious flow of blood; but this, it is alleged, does not ha with lungs that have not breathed. In performing this experiment on a occasions, I have not been able to perceive any well marked difference. blood in the new-born child may be found coagulated or not, and there is no ference in this condition, whether it be born living or dead.

7. *Relative proportion of fat in the lungs.*—In July, 1847, a memoir was pr sented to the Academy of Sciences by M. Guillot, in which the author prop to determine the question of respiration by the relative proportion of fat con in the lungs before and after birth. According to M. Guillot, the quantity fat contained in the pulmonary tissue is always greater before than after resp tion, and begins to diminish from the moment that the act of breathing commen Before respiration, the dried lungs yield from ten to eighteen per cent. of fa after respiration, not more than six per cent. The process followed by M. Gu is to dry the organs at a high temperature, so as to expel all the water,—reduc them to powder, and digest this powder in ether. (Comptes Rendus, Juillet 19, 1847, 77.) It need hardly be observed that this process could not be made available in practice. Admitting the facts as stated, the difference between six and ten per cent. may disappear by further observations. A want of chemical accuracy might lead to serious mistakes. The process, however, is open to this objection:—if respiration have been fully performed, this will be sufficiently evident from the state of the lungs; and if imperfectly performed, as the change is alleged to depend on the respiratory act, the result of an analysis cannot avail to remove the difficulty.

8. *The specific gravity of the lungs.*—The specific gravity of the lungs is greater before than after respiration; for although the organs become absolutely heavier by the establishment of the process, this is owing, not to the air, but to the additional quantity of blood received into them. The air thus received so increases the volume of the organs, as to more than counteract the additional weight derived from the blood, and thus apparently to diminish their specific gravity. Under these circumstances the organs readily float on water. From several experiments, I have found that the specific gravity of the lungs before respiration, *i. e.* in the fœtal condition, varies from 1·04 to 1·05. They are about one-twentieth part heavier than their bulk of water. After respiration, the specific gravity of the lungs with the air contained in them, I found in one experiment to be 0·94; *i. e.* the organs were about one-seventeenth part lighter than their bulk of water. Thus it is that a very small quantity of air will render these organs buoyant in water; and an alteration in the volume of the lungs sufficient for this purpose

would not be perceptible to the eye. It will be understood that the specific gravity of the substance of the lungs is unchanged; the organs are rendered only apparently lighter by the air contained in their cells, on the same principle as a distended bladder. Hence it follows, that the same apparent diminution of specific gravity will take place whether the air be derived from respiration, artificial inflation, or putrefaction. It is on this property of the lungs that the application of what is termed the *hydrostatic test* or the *docimasia pulmonaris*, is founded, —a subject which may be appropriately considered in another chapter.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter are:—

1. That a child may be born alive and be criminally destroyed before it has breathed.
2. That the presence of any marks of putrefaction in utero proves that the child must have come into the world dead.
3. That the characters accompanying certain marks of violence may occasionally show that the child was living when the violence was applied to it.
4. That there are no certain medical signs, by which a child which has not breathed can be proved to have been living when it was maltreated.
5. That a new-born child may be destroyed by the prevention of respiration during delivery.
6. That the proof of respiration shows that the child has *breathed*, not that it has been *born alive*.
7. That by taking together the colour, volume, consistency, absolute weight and buoyancy of the lungs, we may be able to draw an inference as to whether the child has or has not respired.
8. That the lungs increase in weight according to the degree to which respiration is established, and not necessarily according to the period which the child has survived birth.
9. That no reliance can be placed upon the test of Ploucquet, or the proportionate weight of the lungs to the body.
10. That no reliance can be placed upon the relative quantity of blood in the pulmonary vessels, or the relative proportion of fat contained in the pulmonary tissue, as evidence of respiration having been performed.

CHAPTER XL.

MODE OF EMPLOYING THE HYDROSTATIC TEST—INCORRECT INFERENCES—SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS—LIFE WITH PARTIAL DISTENTION OF THE LUNGS —LIFE WITH PERFECT ATELECTASIS OR ENTIRE ABSENCE OF AIR FROM THE LUNGS —HYDROSTATIC TEST NOT APPLICABLE TO SUCH CASES—ERRONEOUS MEDICAL INFERENCE FROM SINKING OF THE LUNGS—FLOATING OF THE LUNGS FROM EMPHYSEMA AND PUTREFACTION—EFFECTS OF PUTREFACTION IN AIR—GENERAL CONCLUSIONS RESPECTING THE HYDROSTATIC TEST.

Mode of employing the hydrostatic test.—The hydrostatic test has been long known, and various opinions have been entertained relative to its efficiency and value. Many of the objections that have been urged to its use appear to have arisen from a mistaken view of the evidence which it is capable of furnishing. The term "test" is decidedly improper, since there are cases in which it does not enable us to decide whether a new-born child has come into the world living or dead. It is, however, for the sake of convenience, here retained. When the hydrostatic test is properly applied, and with a full knowledge of the exceptions

to which it is exposed, it may afford in many cases good evidence whether a child has or has not respired. The mode of performing the experiment is extremely simple. Having removed the lungs from the chest, they should be placed, still connected by the trachea and bronchi, upon the surface of distilled or river water. If they sink, it should be noted whether the sinking takes place rapidly or slowly. If they both sink, the two lungs should be tried separately; for it is sometimes found that one, commonly the right, will float while the other will sink. Supposing that both lungs sink, it will then be proper to divide each into twelve or fifteen pieces, and place these pieces separately on water. If, after this, they still sink, the inference is, that though the child may have lived and survived its birth, *there is no evidence of its having respired.* On the other hand, the organs when placed on water may float: it should then be noticed whether they float high above the surface, or at or below the level of the water; sometimes they indifferently float or sink. These differences will lead to a conclusion respecting the degree to which respiration has taken place. It will now be proper to separate the lungs, and determine whether the buoyancy be due to one or both. Each lung should be divided, as before, and each piece separately tried. If all the pieces float, even after firm compression, we have good evidence, *cæteris paribus*, that respiration has been very perfectly performed. Should any of the divided portions sink in water either before or after compression, our opinion may be modified accordingly. Some have recommended that the lungs should be placed on water with the heart and thymus gland attached; but there appears to be no good reason for this, since it is as easy to form an opinion of the degree of buoyancy possessed by the lungs, from the readiness with which they float, as by observing whether or not they have the power of supporting these two organs.

Incorrect inferences.—Such, then, is the method of employing the hydrostatic test in cases of infanticide. With regard to its use in medical jurisprudence, it should be observed that the floating of the lungs in water is not, as it is often incorrectly represented to be, a proof that the child has been *born alive;* nor is the fact of their sinking in water any proof that the child was *born dead.* The floating under the limitations to be now described, proves only that the child has *breathed;* the sinking, either that it has *not breathed*, or breathed but imperfectly. The fact of a child having been *born* living or dead, has, strictly speaking, no relation to the employment of the hydrostatic test. There are, indeed, cases of infanticide which may be readily established without resorting to this test: all that the law requires is proof of a child having been born living,—whether this proof be furnished by the state of the lungs through the hydrostatic test, or in any other way, is of no moment. The signs of life are commonly sought for in the lungs, because it is in these organs that the changes produced by a new state of existence are first perceived; but this examination may be dispensed with, when the woman confesses that the child was born alive—when others have seen it manifest life by motion or otherwise after its birth; or lastly, in cases, where, without being seen, it has been heard to cry. The crying of a child has been admitted as evidence of live birth on several trials for infanticide; although, from what will be hereafter said, it is possible that a child may be heard to cry, and die before its body is entirely born. Among the *objections* which have been urged to the employment of the hydrostatic test, we have first to consider those which concern the sinking of the lungs in water.

SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS.

It is said that the hydrostatic test cannot show whether a child has or has not survived its birth, because the lungs of children that have lived for a considerable period have been observed to sink entirely in water. In some instances this may depend on disease, tending to consolidate the air cells, as *hepatization* or *scirrhus;* in others, on *œdema* or *congestion;* but these cases can create no difficulty, since the reason for the lungs sinking in water would be at once obvious

on examination. The hepatized portion of lung may be known by the firmness with which it resists cutting with a knife, as also by the fact that it is impossible to distend it artificially with air. On the other hand, there are cases in which the lungs appear healthy and unaffected; all that we can perceive is, that they retain their fœtal condition. This is a very different state to that of hepatization, because the lungs may, in this case, be made to receive air by artificial inflation. It is remarkable that life should continue for many hours, and sometimes even for days, under such a condition; but the occasional existence of this state of organs in a living child is placed beyond all dispute;—the explanation of the causes upon which it depends—how it is that a child may live and breathe for hours or days, and no signs of respiration are discovered in its body after death, is involved in great difficulty. The researches of Dr. E. Jörg, of Leipzig, have, however, thrown some light upon the subject; and these may probably lead the way to other discoveries in this obscure department of physiology. Some of Dr. Jörg's views are peculiar. He considers that the act of parturition, as well as the duration of the process, has a material influence upon the system of a child; and that these conditions serve to prepare it for the efforts which it has to make in performing respiration. (Die Fötuslunge, Grimma, 1835.) Supposing the first inspirations made by a child to be, from any cause, feeble or imperfect, then the organs will become only partially distended; the remaining portions will preserve their fœtal condition. Dr. Jörg considers this as a positively diseased state of the lungs in the new-born child, and he has given to it the name of *atelectasis;* ατελης "incomplete;" εκτασις "expansion." It may proceed from various causes. He considers that children which are born after a very easy and rapid delivery are subject to it; and thus it may be found in a mature, as well as in an immature child. Any cause which much weakens the vital powers of a child before its actual birth, may give rise to the occurrence of this imperfect dilatation of the lungs. In this way it may be due to long-continued pressure on the head during delivery, or to hemorrhage from the cord. All the causes of asphyxia in a new-born child will, when operating only in a very slight degree, also produce this atelectasic condition. When only a part of the lungs becomes, in the first instance, distended, the child may not afterwards acquire sufficient strength to fill the remaining portions; it may thus live on for some hours or days, respiring at intervals, and becoming occasionally convulsed, in which state it will probably sink exhausted and die. Jörg has remarked that those portions of the lung which are not speedily distended by air, afterwards become consolidated or hepatized, so that all traces of their vesicular structure are lost. The length of time which the child survives will depend upon the degree to which its lungs have become dilated. This condition of the lungs is sometimes to be clearly traced to the diversion of the blood supplied to the lungs, by reason of the ductus arteriosus or foramen ovale remaining open after birth.

Life with partial distention of the lungs.—It is not necessary that the whole of the lungs should have received air, in order that a child should continue to live even for some months after its birth. A few years ago, I met with the following case, which will serve to illustrate this statement. A child, aged six months, had been, it was supposed, destroyed by suffocation. Upon opening the thorax, the viscera were found healthy; but the whole of the inferior lobe of the right lung was, so far as regarded colour, density, and structure, precisely like the lungs of the fœtus,—no air having ever penetrated into it. It had become developed in size, but its vesicular structure was perfectly destroyed. When the whole of the lung was placed in water, it floated; but when the inferior lobe was separated, it immediately sank to the bottom of the vessel. I have no doubt that this was a case of atelectasis, such as it is described by Jörg. The lobe had not received air in the first instance, and had become afterwards consolidated or hepatized, so that it could not be inflated. Dr. Albert met with a case where a child died *thirty-six hours* after its birth, having been attacked by convulsions

at intervals during that time. On inspection the whole of the right and the lower lobe of the left lung were found to be in their fœtal condition, and they immediately sank when immersed in water. There was no diseased appearance in the organs, and the undistended portions were easily filled by blowing air into them. (Henke's Zeitschrift, 1837, ii. 422.) M. Depaul found that in many cases where children had died suddenly after breathing for several hours or days, there was no other morbid appearance to be perceived than an unexpanded condition of a large portion of the lungs. (Med. Gaz. xxxix. 283.)

Life with perfect atelectasis, or entire absence of air from the lungs.—It is quite necessary for a medical jurist to be aware, that this state of the lungs, which is here called *atelectasis*, is by no means unfrequent among new-born children, although attention has been only of late years drawn to the subject. When no portion of air is found in the lungs of a child, there is no test by which such a case can be distinguished from one where the child has come into the world dead. These cases of atelectasis are ordinarily set down as exceptions to a very general rule; but I cannot help thinking, that they are more common than some medical jurists are inclined to admit. In examining the body of a child, the history of which is unknown, it is therefore proper that the possible occurrence of these cases should be well borne in mind. It appears to me not improbable, that many such come yearly before coroners in this country; and that they are dismissed as cases of still-born children, notwithstanding that marks of violence are often found upon the bodies. If, as it has been already observed, the lungs sink in water, the fact is commonly regarded as sufficient evidence of still-birth. This is assuredly putting the most humane interpretation on the circumstances, and so far the result is not to be objected to; but we should take care, in carrying out this principle, that we do not throw obstacles in the way of judicial inquiry, and lead to the concealment of crime. Professor Bernt met with an instance in which a seven-months child died *two hours* after birth; and when its lungs were divided and placed in water, every fragment sank. Remer has reported another, in which the lungs sank in water, both entire, as well as when divided, although the child had survived its birth at least *four days*. (Henke, Lehrbuch der G. M. p. 374.) In this case, the navel-string separated naturally before death. Orfila found, in a child which had lived *eleven hours*, every portion of the lungs, when divided, to sink on immersion. In three other cases, in which the subjects survived birth four, six, and ten hours, the lungs also sank when divided; two of these were mature children. (Méd. Lég. i. 375.) Other instances are recorded by Daniel, Schenk, and Osiander. Metzger supposed that premature children alone were likely to present this anomaly; *i. e.* of continuing to live after birth without leaving any clear signs of respiration in their lungs. Perhaps the greater number of these cases have occurred among immature children; but recent observations satisfactorily prove that perfectly mature children may also be the subjects of this singular condition.

I may add to these instances, two which have occurred under my own observation. In one, the case of a mature male child, the lungs sank in water, although the child had survived its birth for a period of *six hours*. In the other, the case of a female twin, the child survived *twenty-four hours*, and after death, the lungs were divided into thirty pieces, but not a single piece floated; showing, therefore, that although life had been thus protracted, not one-thirtieth part of the structure of the lungs had received from respiration sufficient air to render it buoyant, (Guy's Hospital Reports, No. v. p. 355.) In the latter instance, no particular remark was made during life respecting the respiration of the child. These cases show most clearly that buoyancy of the lungs is not a necessary consequence of a child having lived and breathed for some time after birth. Probably, had this been a case calling for medico-legal inquiry, the lungs would have been cut to pieces; the sinking of the divided pieces in water, either before or after compression, would have been set down as negativing the act of respira-

tion, and, unless other strong evidence were forthcoming, the fact of the child having survived its birth. Here, again, we perceive the necessity of not hastily assuming that a child has been *born dead*, because its lungs *sink* in water.—There may be no good medical evidence of such a child having lived after birth, but assuredly the mere sinking does not warrant the common dictum, that the child was necessarily dead when born: it would be as reasonable to pronounce, in a question of poisoning, that the fact of an individual having died from poison was negatived by the non-discovery of a poisonous substance in the stomach of the deceased.

Hydrostatic test not applicable to such cases.—It must be apparent, on reflection, that cases of this description are beyond the reach of the hydrostatic as well as of all other tests applied to the respiratory organs; because the lungs do not receive and retain a perceptible quantity of air, although the subjects may have lived some hours. The hydrostatic test is no more capable of showing that such subjects as these had lived, than it is of indicating from what cause they have died. Facts of this kind demonstrate that passive existence may be for some time continued under a state of the respiratory process not to be discovered after death. In the opinion of some, these cases form a serious objection to the hydrostatic test; but it is difficult to understand how they can affect its general application,—or why, because signs of respiration do not always exist in the lungs of children which have lived, we are not to rely upon them when they are actually found. Poison is not always discoverable after death in the stomach of a person who has taken it; but this does not prevent a medical jurist from searching for it, and, under proper precautions, relying upon its discovery, as evidence of poisoning in another case. These singular instances prove that we are greatly in want of some sign to indicate life after birth, *when the marks of respiration are absent.* Until we discover this, we must, of course, make the best use of that knowledge which lies at our disposal; taking care to apply it to those cases alone to which experience shows it to be adapted. In the mean time, the common inference that a child has been born dead because its lungs sink in water, is never likely to implicate an innocent party; it can only operate by sometimes leading to the liberation of the guilty.

Erroneous medical evidence from sinking of the lungs.—From the cases already reported, it is a fair subject of consideration whether a great error is not committed by those medical practitioners who pronounce all children to have been born dead, merely because the lungs contain no air and readily sink when placed on water. This, it is true, is the common opinion, but it is not warranted by observation. We are only entitled to say, in all such cases, that there is *no evidence* of a child having breathed or lived. Many might be disposed to consider it an unnecessary degree of refinement, to hesitate to express an opinion that a child was born dead when its lungs sank entirely in water, because certain cases have occurred wherein these characters have been possessed by lungs taken from the bodies of children that have survived their birth many hours. To those inclined to adopt this view, I would say, the answer to such a question is of far greater importance in a medico-legal, than in a medical light. In the latter case, no responsibility can be attached to the expression of the opinion commonly adopted: in the former case, however, when the question refers to child-murder, a serious responsibility attaches to a practitioner; and he can only guard himself from unpleasant consequences, by basing his evidence on carefully observed facts. If a child can live for six or twenty-four hours, without its lungs receiving sufficient air to allow even one-thirtieth part of their substance to float, it is clear that such a child may be the subject of a murderous assault; and if a medical practitioner, losing sight of this fact, proceed to declare, from the lungs sinking in water, that the child must have been *born dead*, his assertion may afterwards be contradicted, either by circumstances, by the testimony of eye-witnesses, or by the confession of the woman herself. He will be required, perhaps, to revise

his opinion; and he will then find, that the fact of the lungs sinking in water is rather a want of evidence of life after birth, than a positive proof of a child having been born dead. It cannot be denied that the sinking of the lungs is a presumption in favour of still-birth, but it is nothing more;—it is not, as it is often set down, a direct or positive proof of the child having been born dead. There are many cases reported which show that this is not an unnecessary caution. Meckel relates two instances where the lungs sank in water, but the women respectively confessed that they had destroyed their children: according to the general rule, these children must have been born dead, and no murder could have been committed! (Gerichtl. Med. 365.) For other examples of a similar kind, I must refer to the following journals: Ann. d'Hyg. 1837, i. 437; also 1841, 429; Henke's Zeitschrift, 1840, xxvii. Erg. H.; Brit. and For. Med. Rev. Jan. 1842, p. 250. The cases there reported appear to me to convey a serious warning to medical witnesses, on the danger of expressing an opinion not strictly warranted by the facts, and which must be in such cases merely speculative. A case of some interest in this point of view has been communicated to the Medical Gazette, by Dr. Davies, of Hertford. In November, 1847, he was required to examine the body of a child found under suspicious circumstances. It was in a pasteboard box, of small size, with the lid turned inside out, and on the top there was a quantity of mould. The body was found buried in a garden. It turned out on inquiry that there had not been exactly a concealment of birth on the part of the mother, who was an unmarried woman. The body was fifteen inches long from crown to sole; eyelids were adherent; testicles (it was a male child) had not descended; it weighed one pound and three-quarters. It was ascertained that it had been buried a fortnight, which accounted in some degree for the lightness of its weight in proportion to its length, and for a slight peeling off of the cuticle from some parts of the arms: the body looked otherwise healthy. The age was probably about seven months. On examining the lungs they were found to be quite firm, like the liver; *they sank in water both entirely and in parts.* The right lung was of a dark brown mahogany colour, but the upper lobe of the left was of *rather a lighter colour* than any other part of the lungs. However, this lobe sank immediately upon being put in water. The evidence at the inquest proved that the child was not only *born alive*, but that it had lived *ten minutes* at least, and perhaps longer, after birth. It appeared that an elderly woman, living close by, was sent for, and when she arrived she found the child, with the placenta attached to it, in the close-stool. She noticed that the child moved its arms; she therefore took it up with the placenta, and wrapped it in flannel. It continued to move its limbs for *ten minutes*, according to her account, *but it uttered no cry.* When the child ceased to move, she divided the cord seven inches from the body, and tied it into a knot. (Med. Gaz. xl. 1022.)

It has been recommended that medical jurists should consider as dead every child that has not breathed; *i. e., whose lungs sink in water;* but they who give this advice at the same time admit that children may come into the world living without breathing; and the law holds, under the decisions of its expounders, that respiration is only *one*, and not the exclusive proof of life. In order to establish life or even live birth, respiration need not always be proved, either in civil or criminal cases. (*Fish* v. *Palmer*, 1806. See post, BIRTH.) A medical jurist would therefore be no more justified in asserting that all such children were necessarily born dead, than that they were born living: and in stating what is the plain and obvious truth, it is not possible that he can ever be the means of involving an innocent person. It is certain, however, in departing from the truth, and stating what is contrary to well known facts, that when the lungs of a child sink in water, it is safe and just to consider such child as having been born *dead*, he is incurring the risk of exculpating a really guilty person; for it cannot be too strongly borne in mind, that a woman is not charged with murder, merely

because the lungs of a child float or sink in water, but because there are upon its body marks of violent injuries apparently sufficient to account for the death of a new-born child, or very strong moral presumptions of her guilt. (See Ann. d'Hyg. 1836, ii. 362.)

BUOYANCY OF THE LUNGS FROM OTHER CAUSES THAN RESPIRATION.

Another series of objections has been urged to the hydrostatic test, based on the fact that the lungs may receive air and acquire buoyancy from other causes than respiration. These causes are two: *putrefaction* and *artificial inflation*. It was supposed that the lungs of a still-born child might become emphysematous from a compression of the sides of the thorax during delivery; but it is difficult to understand how in this way air should be extricated from these organs any more than it would be from the liver under similar circumstances. The truth probably is, that what has been described as *emphysema* of the lungs in still-born children was nothing more than partial or imperfect respiration performed during delivery. In examining the bodies of many still-born children, I have never met with any appearance resembling what has been described as a state of emphysema, independently of respiration and putrefaction. It may be proper, however, to state, that according to some observers, emphysema of the lungs may be produced under the following circumstances:—The thorax of the child is compressed in passing the outlet,—the lungs within are thereby compressed; and if this compressing force be suddenly removed, as by the thorax escaping, the elasticity of the parietes will cause the chest to expand, and air, it is presumed, will enter as a necessary consequence. The simultaneous compression of the abdomen might aid in the entrance of the air. (Lancet, May 20, 1837; also, June 17, 1837.) It is contended that not only may respiration take place during birth, but that even the lungs of the *dead* fœtus may become thus mechanically inflated, and simulate respiration.

This opinion appears to be founded on an erroneous view of the condition of the thoracic viscera in the chest. The lungs are as dense as the liver before air has entered into them. If they be compressed they may become elongated, but when that pressure is removed, they will, if the child be dead, simply return to their original fœtal condition. To suppose that they would expand and receive air, is to suppose that the reaction of the thoracic parietes is greater than the force with which they have been compressed. But what is to carry the thorax of a a dead child beyond the point at which equilibrium is restored? Besides, this would not suffice to distend the air-cells, which are yet coiled up as it were and condensed. If this view were correct, scarcely a child would be born without having air in its lungs. In experimenting on this subject, I have never observed the least portion of air to enter:—the air-cells of the lungs do not therefore appear to be in the condition of spiral springs, which this hypothesis would represent.

Floating of the lungs from putrefaction.—The lungs of a still-born child, when allowed to remain in the thorax, are slow in undergoing putrefaction; but nevertheless, they may sooner or later acquire sufficient air to render them buoyant in water. This form of gaseous putrefaction may even take place in the lungs of a child which has died in utero. One instance of the kind is recorded by Dr. Albert, (Henke's Zeitschrift, 1837, ii. 379,) in which the child was cut out of the uterus in a putrefied state, and its lungs floated when placed on water. It has been also alleged, that the formation of air may take place in the lungs from putrefaction, without this being indicated by change in colour, smell, or other properties of the organs; but admitting that this occurs, it can create no difficulty in the investigation.

When the lungs are putrefied, this will be determined, in general, by putrefaction having extended throughout all the soft parts of the body. The organs, according to the degree of putrefaction, will be found soft, of a dark green or

brown colour, and of a highly offensive odour; the serous membrane covering the surface will be raised in large visible bladders, from which the air may be forced out by very moderate compression. It has been remarked, that under the same conditions, gaseous putrefaction takes place as rapidly in the liver, heart, and thymus gland of a new-born child, as in the lungs. We should therefore examine the general condition of the body: the distention of the lungs with gas from putrefaction cannot be easily overlooked or mistaken for the air of respiration. The answer to any objection founded on the putrefied state of these organs, must at once suggest itself. It is impossible that any well informed medical witness can expect to obtain satisfactory evidence from experiments on the lungs of such subjects. He should at once abandon the case, and declare that in regard to the question of respiration, medical evidence cannot establish either the affirmative or the negative. The fact of his not being able to give the evidence required, cannot be imputed as a matter of blame to him; because this is due to circumstances over which he has no control. In a case of poisoning, the post-mortem appearances in the viscera may be entirely destroyed by putrefaction; but no practitioner would think of looking for proofs where the circumstances rendered it utterly impossible for him to obtain them.

A case may possibly occur, wherein the characters presented by the lungs will be such as to create some doubt whether the buoyancy of the organs be due to putrefaction or respiration, or, what is not unusual, whether the putrefied lungs may not also have undergone the changes of respiration. The facts may be apparently explicable on either assumption. Even here a proper investigation may serve to remove all doubt. (See case by Dr. Francis, Med. Gaz. xxxvii. 460.) It has been recommended on these occasions that the witness should lean to the side of the prisoner,—in other words, he should give an opinion, that the child suspected to have been murdered had not respired. This advice is equal to recommending a witness to take upon himself the duty of a jury, and virtually to acquit a prisoner upon a doubt existing in his own mind, in respect to only *one* portion of the evidence adduced against her. The evil effects of following this kind of advice are well shown by a case reported in Henke's Zeitschrift, (1843, i. 102, Erg. H.) where an opinion was improperly given by a medical witness, that the child, the whole of the organs of whose body were in an advanced state of putrefaction, was born *dead;* and the prisoner afterwards confessed that it had been born *living!* This shows that it is always better to leave a doubtful case as we find it, than to express a positive opinion on one side or the other, when this opinion can never amount to more than a conjecture. If a witness were simply to assure the jury, that medical evidence could not solve the question whether the child had lived,—if he were to assert what is really the fact, that his experiments would not allow him to say whether the child had or had not respired,—it is certain that no innocent person would ever be convicted or a guilty person acquitted, upon his evidence. It is for a jury only to judge of guilt from *all* the circumstances laid before them; but it is assuredly not for a medical witness to prevent all further investigation, and put an end to the case, by leaning to the side of the accused when there is really a doubt upon his mind. It is his duty to state that doubt, and leave the decision of guilt or innocence in the hands of the Court.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter respecting the application of the hydrostatic test in cases of infanticide, are the following:—

1. That the hydrostatic test can only show whether a child has or has not breathed,—it does not enable us to determine whether a child has been born living or dead.

2. That the lungs of children which have lived after birth may *sink* in water owing to their not having received air, or to their being in a diseased condition.

3. That a child may live for a considerable period when only a portion of the lungs has been penetrated by air.

4. That a child may survive birth, even for twenty-four hours, when no part of its lungs has been penetrated by air.

5. Hence the sinking of the lungs (whether whole or divided) in water, is not a proof that a child has been *born dead.*

6. That the lungs of children which have not breathed and have been born dead, may float in water from putrefaction or artificial inflation.

7. That the lungs as situated in the chest undergo putrefaction very slowly,—that if but slightly putrefied, the air may be easily forced out by compression, and if much putrefied, either the case must be abandoned, or other sources of evidence sought for.

CHAPTER XLI.

FLOATING OF THE LUNGS FROM ARTIFICIAL INFLATION. INFLATION DISTINGUISHED FROM PERFECT RESPIRATION—NOT DISTINGUISHABLE FROM IMPERFECT RESPIRATION—DOUBTFUL CASES—RESULTS OF COMPRESSION—IMPROPER OBJECTIONS TO THE HYDROSTATIC TEST—SUMMARY—RESPIRATION BEFORE BIRTH—VAGITUS UTERINUS—RESPIRATION A SIGN OF LIFE, NOT OF LIVE BIRTH—THE KILLING OF CHILDREN WHICH BREATHE DURING BIRTH NOT CHILD-MURDER. GENERAL CONCLUSIONS.

Floating of the lungs from artificial inflation.—It has been alleged that the lungs of a still-born child may be made to assume, by artificial inflation, all the characters assigned to those which have undergone respiration. Thus, it is said, a child may not have breathed, and yet the application of the hydrostatic test would lead to the inference that it had. It will be seen that the force of the objection goes to attack directly the inference derived from the presence of air in the lungs. This objection can, it appears to me, be admitted only under one form, namely, as it applies to lungs which have been inflated while *lying in the cavity of the chest.* Any experiments performed on inflation after their removal from this cavity, can have no practical bearing; since in a case of infanticide we have to consider only the degree to which the lungs may be inflated by a person who is endeavouring to resuscitate a still-born child. The difficulty of inflating the lungs of a new-born child is too well known to require to be here adverted to; the greater the violence used, the less likely is the air to pass into these organs, but it rather finds its way through the œsophagus into the bowels. Dr. Albert, a late writer on the subject, denies that the organs while lying in the chest can be so filled with air, either by the mouth or by means of a tube, as to be rendered buoyant in water. In performing this experiment several times, he never found a trace of air in the air-cells; and he contends that medical jurists have begun at the wrong end (den Gaul von hinten aufgezaümt,) in endeavouring to seek for answers to an objection, before they had ascertained that such an objection could have, practically speaking, any valid existence. (Henke, Zeitschrift, 1837, ii. 390.) M. Depaul has still more recently found that it required great force to inflate the lungs, and that their resiliency was sufficient to expel the greater part of the air. (Med. Gaz. xxxix. 283.)

Having had several opportunities of examining the lungs of children in which inflation had been resorted to, not for the express purpose of creating an objection to the hydrostatic test, but with the *bonâ fide* intention of resuscitating them, I may here state the results. In some of these instances a tube had been used, and in others the mouth. In the first case it was found, on inspection, that only about one-thirteenth part of the structure of the lungs had received air. In

the second, no part of the lungs had received a trace of air, although inflation had been repeatedly resorted to; the air had passed entirely into the abdomen. In a third, attempts were made for upwards of half an hour to inflate the organs, but on examination, not a particle of air was found to have penetrated into them. In a fourth, no air had entered the lungs, and in a fifth, although a small portion had penetrated into the organs, it was readily forced out by compression. In repeatedly performing experiments on dead children, the results have been very similar; the lungs, after several attempts, were found to have received only a small quantity of air. Thus, then, it would appear, that the lungs of a new-born child may be inflated *in situ*, although with some difficulty, and that the quantity of air which they receive under these circumstances is inconsiderable. If the efforts at inflation be continued for some time in the dead body, and the tube be violently introduced into the larynx or trachea, or if the organs be inflated, after removal from the thorax, with the express intention of causing them to resemble respired lungs, the case is different: but this is not the way in which the objection can possibly occur in a case of infanticide,—a circumstance which appears to have been strangely overlooked by some of those who have examined this alleged objection to the hydrostatic test. It is not likely that a woman, if able to perform the experiment at all, would be capable of doing more than a practised accoucheur; and the probability is, that she would, in general, altogether fail in the attempt. One case is recorded, where a woman recently delivered is stated to have succeeded in artificially inflating the lungs of her child (Meckel, Lehrbuch der G. M. 368:—see also Ed. Med. and Surg. Jour. xxvi. 374;) and another, in which this defence was urged on the part of the female, is reported by Dr. von Siebold, of Göttingen (Henke's Zeitschrift der S. A., iii. 1845.) The child in this instance, was found with its head cut off, and the lungs contained air. The inconsistency of the woman's statement as to the mode in which she inflated the lungs was clearly proved, and the examiners did not hesitate to give a decided opinion that the air found in the lungs had been derived from the act of respiration, and not from artificial inflation. The whole case shows clearly that when a theoretical objection of this kind comes to be tested practically, it ceases to present any difficulty.

But let it be admitted that the lungs are artificially inflated; in this case, they would resemble, by their partial distention with air, and other physical characters, those of children which had imperfectly breathed. Like them, they may float on water; but on cutting them into pieces, some of these would be found to sink. If the pieces be firmly compressed either by means of a folded cloth or between the fingers, they will lose their air and sink; so that in fact there are no physical means of distinguishing artificially inflated lungs from those that have imperfectly breathed. Experiment has repeatedly shown that where the respiration has been very feeble, and no artificial inflation resorted to, the air may be forced out of the lungs by moderate compression, and the portion so compressed will sink in water. If the compression be performed under water, bubbles of air may be seen to rise through the liquid. The results I have found to be exactly the same with lungs inflated artificially as they were lying in the chest. (See Guy's Hospital Reports, No. V., and for some remarks on this subject by Dr. Christison, see Ed. Med. and Surg. Jour. xxvi. 74.)

Artificial inflation distinguished from perfect respiration.—If respiration has been *perfectly* established, and the lungs are well filled with air, it is impossible so to expel this air by compressing the divided portions of the organs, as to cause them to sink in water. It has been asserted that it is equally impossible to force the air out of lungs that have been artificially inflated; but it is highly probable that in these cases the lungs have been inflated to a maximum degree when removed from the thorax, a case in which much difficulty is certainly experienced in expelling the air; but this is not the form in which the objection can ever present itself in a case of infanticide. If the lungs be inflated in the ordinary

, while lying within the thorax, there is never, according to my obser-
ıy great difficulty in causing them to lose their air by compression,—a
ıich has been repeatedly demonstrated to the medico-legal classes of
ɔspital. Although no reliance can be placed on the effects of compres-
ıses of *imperfect respiration*, yet it appears to me that when, with great
the lungs, there is great buoyancy in water, the fact of their not losing
ıntained in them, and not sinking after very firm compression, ought to
ered as a good corroborative proof of the child having breathed. It has
stated that compression will not extricate air from lungs which have
ɔired. By this, it is not to be understood that the experiment of com-
ɔan only be practically applied, to distinguish respiration in those cases
a child has lived for a considerable time after its birth. I have found
eed, even where a child had lived to make no more than one or two re-
ı, and had died before it was actually born. In this case, it was found
, in order to effect delivery, to destroy the child while the head was
g. It lived, however, a sufficient time after the protrusion of its head,
greater part of the brain destroyed, to cry loudly for an instant. The
ppearance of the body showed that it had attained to the full period of

On opening the thorax, the lungs were seen projecting slightly for-
ɛr the sides of the pericardium. They were of a light-red colour, but
ant under the finger. They had the external physical characters which
ans are known to acquire on the first establishment of respiration; but
ce of crepitation proved that the process could not have been perfectly
l. The colour of the external surface was throughout uniform, a cir-
e which I have never witnessed in lungs that had been artificially in-
ɔept where the inflation had been carried to its fullest extent out of the
hen, however, there is, commonly, distinct crepitation. When removed
d on water, these organs floated freely; and on being separated, both
equally buoyant. Each lung was next divided into sixteen pieces, and
ce floated. In dividing them, it was observed that the colour was uni-
ughout their substance; there was no sense of crepitus under the knife;
the cells, in which the air was diffused, be seen. The pieces were then
to very forcible compression, for a considerable time, in a folded cloth.
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the second, no part of the lungs had received a trace of air, although inflation had been repeatedly resorted to; the air had passed entirely into the abdomen. In a third, attempts were made for upwards of half an hour to inflate the organs, but on examination, not a particle of air was found to have penetrated into them. In a fourth, no air had entered the lungs, and in a fifth, although a small portion had penetrated into the organs, it was readily forced out by compression. In repeatedly performing experiments on dead children, the results have been very similar; the lungs, after several attempts, were found to have received only a small quantity of air. Thus, then, it would appear, that the lungs of a new-born child may be inflated *in situ*, although with some difficulty, and that the quantity of air which they receive under these circumstances is inconsiderable. If the efforts at inflation be continued for some time in the dead body, and the tube be violently introduced into the larynx or trachea, or if the organs be inflated, after removal from the thorax, with the express intention of causing them to resemble respired lungs, the case is different: but this is not the way in which the objection can possibly occur in a case of infanticide,—a circumstance which appears to have been strangely overlooked by some of those who have examined this alleged objection to the hydrostatic test. It is not likely that a woman, if able to perform the experiment at all, would be capable of doing more than a practical accoucheur; and the probability is, that she would, in general, altogether fail in the attempt. One case is recorded, where a woman recently delivered is stated to have succeeded in artificially inflating the lungs of her child (Meckel, Lehrbuch der G. M. 368:—see also Ed. Med. and Surg. Jour. xxvi. 374;) and another, in which this defence was urged on the part of the female, is reported by Dr. von Siebold, of Göttingen (Henke's Zeitschrift der S. A., iii. 1845.) The child, in this instance, was found with its head cut off, and the lungs contained air. The inconsistency of the woman's statement as to the mode in which she inflated the lungs was clearly proved, and the examiners did not hesitate to give a decided opinion that the air found in the lungs had been derived from the act of respiration, and not from artificial inflation. The whole case shows clearly that when a theoretical objection of this kind comes to be tested practically, it ceases to present any difficulty.

But let it be admitted that the lungs are artificially inflated; in this case, they would resemble, by their partial distention with air, and other physical characters, those of children which had imperfectly breathed. Like them, they may float on water; but on cutting them into pieces, some of these would be found to sink. If the pieces be firmly compressed either by means of a folded cloth or between the fingers, they will lose their air and sink; so that in fact there are no physical means of distinguishing artificially inflated lungs from those that have imperfectly breathed. Experiment has repeatedly shown that where the respiration has been very feeble, and no artificial inflation resorted to, the air may be forced out of the lungs by moderate compression, and the portion so compressed will sink in water. If the compression be performed under water, bubbles of air may be seen to rise through the liquid. The results I have found to be exactly the same with lungs inflated artificially as they were lying in the chest. (See Guy's Hospital Reports, No. V., and for some remarks on this subject by Dr. Christison, see Ed. Med. and Surg. Jour. xxvi. 74.)

Artificial inflation distinguished from perfect respiration.—If respiration has been *perfectly* established, and the lungs are well filled with air, it is impossible so to expel this air by compressing the divided portions of the organs, as to cause them to sink in water. It has been asserted that it is equally impossible to force the air out of lungs that have been artificially inflated; but it is highly probable that in these cases the lungs have been inflated to a maximum degree when removed from the thorax, a case in which much difficulty is certainly experienced in expelling the air; but this is not the form in which the objection can ever present itself in a case of infanticide. If the lungs be inflated in the ordinary

way, *i. e.*, while lying within the thorax, there is never, according to my observation, any great difficulty in causing them to lose their air by compression,—a result which has been repeatedly demonstrated to the medico-legal classes of Guy's Hospital. Although no reliance can be placed on the effects of compression in cases of *imperfect respiration*, yet it appears to me that when, with great weight of the lungs, there is great buoyancy in water, the fact of their not losing the air contained in them, and not sinking after very firm compression, ought to be considered as a good corroborative proof of the child having breathed. It has been just stated that compression will not extricate air from lungs which have *fully* respired. By this, it is not to be understood that the experiment of compression can only be practically applied, to distinguish respiration in those cases in which a child has lived for a considerable time after its birth. I have found it to succeed, even where a child had lived to make no more than one or two respirations, and had died before it was actually born. In this case, it was found necessary, in order to effect delivery, to destroy the child while the head was presenting. It lived, however, a sufficient time after the protrusion of its head, with the greater part of the brain destroyed, to cry loudly for an instant. The general appearance of the body showed that it had attained to the full period of gestation. On opening the thorax, the lungs were seen projecting slightly forwards over the sides of the pericardium. They were of a light-red colour, but not crepitant under the finger. They had the external physical characters which these organs are known to acquire on the first establishment of respiration; but the absence of crepitation proved that the process could not have been perfectly performed. The colour of the external surface was throughout uniform, a circumstance which I have never witnessed in lungs that had been artificially inflated, except where the inflation had been carried to its fullest extent out of the body. Then, however, there is, commonly, distinct crepitation. When removed and placed on water, these organs floated freely; and on being separated, both appeared equally buoyant. Each lung was next divided into sixteen pieces, and every piece floated. In dividing them, it was observed that the colour was uniform throughout their substance; there was no sense of crepitus under the knife; nor could the cells, in which the air was diffused, be seen. The pieces were then subjected to very forcible compression, for a considerable time, in a folded cloth. The cloth was ruptured by the force employed; yet on removing the pieces, and placing them on water, they all continued to float. A portion of air had, undoubtedly, been forced out, but not sufficient to deprive any of them of their buoyancy. By this we learn, that in some instances two or three respirations only may suffice to stamp upon the lungs characters whereby they may be easily distinguished from those organs that have undergone artificial inflation. The compression was carried to the furthest possible limit consistently with the preservation of the organic structure of the lungs.

It must not be supposed, that, in all children which have lived but a second or two to respire, similar results will be obtained. The respiration of an instant may distend the lungs of one child, as much as respiration, continued for several hours, would those of another. The time which a child has survived its birth does not allow us to predict to what degree its lungs will be found distended on inspection, or what the results of experiments on these organs will be. A child may have very feebly respired, and died either in a few minutes or hours, or not until many days have elapsed after its birth. There is, of course, no definite boundary between the perfect and imperfect distention of the lungs, but by the latter condition we may understand that state of the healthy organs in which they contain only sufficient air to render them buoyant in water; and from the slight difference in their specific gravity and that of water, a very small quantity will suffice for this. In these cases, moreover, the colour, volume, and consistency, are scarcely changed from the fœtal condition. The admission that air may be compressed out of feebly respired lungs by the same means as out of

those which have been submitted to artificial inflation, may appear to render compression useless, as a diagnostic sign of artificial inflation; but we must not forget, that other corroborative sources of evidence may be forthcoming. The experiment of compression will, I believe, when properly applied, enable us to distinguish cases of complete respiration from those of artificial inflation of the lungs *in sitû;* and, if for this circumstance alone, it ought to be regarded as an adjunct occasionally useful in these investigations.

Artificial inflation not distinguishable from imperfect respiration.—It must, however, be admitted, that there are no means of distinguishing *feeble respiration* from *artificial inflation.* The physical characters of the lungs will be unaltered; and compression will, in either condition, destroy their buoyancy. In a case of this kind, I apprehend the only course left open to a medical witness is, to state to the jury, that the evidence derived from experiments on the lungs left it uncertain whether the child in question had respired, or had had its lungs artificially inflated. The jury will then know how to return their verdict; for it must be remembered, they have always circumstances to guide their judgment, as well as medical opinions; and it is upon the *whole,* and not upon a part of the evidence laid before them, that their verdict is founded. It is singular that this occasional difficulty of distinguishing artificial inflation from respiration, should have been represented as a serious objection to the employment of the hydrostatic test. Even admitting, in the very few instances in which such a defence on the part of a prisoner is possible, that a practitioner is unable to distinguish the one condition from another, this becomes purely a point for the consideration of a jury; it cannot affect the general application of the hydrostatic test. Examples of this sort of difficulty are by no means uncommon in the practice of medical jurisprudence. Many instances might be adduced of medical evidence becoming doubtful from circumstances wholly independent of the skill of the practitioner, and over which he has no possible control. In the determination of any single point in a case of child-murder, whether it relate to live birth or the actual cause of death, a doubt may arise; the question relative to the respiration of the child is not exempted from this rule; but it would be the height of inconsistency to contend, that, because certain means of investigation will not always enable us to express a positive opinion, we should never have recourse to them. I presume that, in the present day, no practitioner would trust to the floating of the lungs as a sign of breathing, before he had ascertained that the air contained in them could not be expelled by compression. The charge against an accused party is not likely, therefore, to be sustained by medical evidence of the respiration of the child, unless the child have actually respired; but it is possible, that, owing to a want of evidence to characterize feeble respiration, a really guilty person may escape upon the bare assumption that the lungs might have been artificially inflated. The mischief to be apprehended is not, then, as it has been often alleged, that the employment of this pulmonary test may lead to the condemnation of an innocent, but rather to the acquittal of a guilty person. This is certainly an unfortunate result; but it is one for which medical science is not yet in a condition to provide an adequate remedy.

In reference to this objection, there are, it appears to me, only two cases which might give rise to some doubt on the source of the air contained in the lungs of a new-born child:—

Doubtful cases.—1. In the case of a child that has not breathed, the lungs may be disproportionately heavy, weighing nine hundred to one thousand grains, and they may have been artificially inflated in the attempt to resuscitate it. Unless, in this case, the air were expelled by compression, an inference might be hastily drawn, that the child had probably breathed. The error could only be removed by circumstantial evidence; which, however, is generally sufficient to remove a speculative objection of this kind. But unless the fœtal lungs were highly congested, diseased, or of extraordinary size, it is not likely that they would weigh

so much as is here supposed. This kind of doubtful case might always be suspected to exist where, with *considerable absolute weight, the lungs contained very little air*. Let us, however, consider what would be its practical bearing on the question of child-murder, supposing the case not to be cleared up by any of the methods above suggested. 1st. The fact of respiration would not be clearly proved, because the great absolute weight of the lungs, without their structure being permeated with air, amounts to nothing. 2dly. Although the proof of respiration might not be made out, this would not show that the child was born dead; for we know that a child may live many hours, and yet no evidence of life may be derived from an examination of the lungs. 3dly. Admitting that there was proof of the child having lived after birth, whether there were evidence of respiration or not, the cause of death would have still to be made out; and unless this be clearly traced to the wilful and malicious conduct of the prisoner—proofs of which are not likely to be derived from the body of a child whose lungs she has innocently inflated—she must be acquitted. Thus, then, it is difficult to understand how, in the hands of one who has attended to the subject of infanticide—and no others ought to be allowed to give medical evidence—this objection, on the ground of inflation, can lead to any difficulty whatever in practice. Such a case as that which I have here supposed, actually occurred to me in June, 1842. A male child, weighing upwards of twelve pounds, died during delivery in a difficult labour. It gave no signs of life when born, and there was no pulsation in the cord. Its lungs were artificially inflated in the attempt to resuscitate it. The organs weighed nine hundred and ninety-four grains. They were slightly crepitant and floated on water, but gentle pressure by the fingers caused them to sink. It was clear that the increased weight depended on their great size, and not on any change produced by respiration. They contained but a very small quantity of air, which was most easily expelled by pressure. In another case, which I examined in June, 1847, the child was born dead. The body was well developed, and the lungs weighed 784 grains. These organs were inflated in situ. On moderate compression, when divided, they immediately sank in water.

2. We will now take the converse objection. A child may live and breathe, and its lungs weigh much under the average of respired lungs, *i. e.* about seven hundred grains. In a case like this, unless the air resist expulsion by compression, an opposite mistake might be made, and we should pronounce a child that had really breathed and survived birth to have been still-born, and had its lungs artificially inflated. This might happen in numerous cases of imperfect respiration after birth, did we not know that the sinking of the lungs, whether containing air or not, and whether this air be expelled by compression or not, does not necessarily prove that the child was born dead. It can only show, under the most favourable circumstances, that it has either not respired, or respired imperfectly. The sinking of the lungs may take place in a child that has survived birth and has really been murdered; but, in such a case, there might be no proofs of life; and therefore a person actually guilty of a crime would be discharged for want of sufficient medical evidence to convict. This, however, could no more justify the entire abandonment of medical evidence in such cases, than it could of general evidence; because this, like evidence which is purely medical, is but too often insufficient to bring home guilt to the really guilty. The objection, therefore, on the ground of artificial inflation, when closely examined, is more speculative than real. Admitting, as some contend, that there is no positive criterion to distinguish this condition from respiration, it is difficult to conceive a case in which the objection could be sustained; and if sustained, it never could lead, in the hands of proper witnesses, to the inculpation of the innocent:—unfortunately for society, it would only add another loop-hole to the many which, through the necessary forms of law, now exist, for the escape of the guilty.

Results of compression.—It is proper to observe, that the results obtained by submitting the lungs to compression in cases of respiration and artificial inflation,

have been very different in the hands of experimentalists equally competent. Some have been able to force out the air in both instances,—others in neither case. These discrepancies may depend either upon the different degrees of pressure employed, or upon the actual degree of distention of the lungs. The fact of their existence shows, at least, that the lung-tests cannot be safely trusted in the hands of persons who have not been used to such investigations. It appears to me that there has been a great deal of misplaced discussion on this subject. One case should at least be adduced, where a woman charged with child-murder has been or can be hypothetically exposed to any risk of conviction from the admission that air cannot by compression be forced out of artificially inflated, or that it can be expelled from respired lungs. I am not aware that there is a single instance in our law records, of such an objection being raised upon any but merely hypothetical grounds, in opposition to all the circumstances of the case. It might be imagined, however, from the discussions among medical jurists, as to the necessity for certain and infallible means of distinguishing artificial inflation from respiration,—that every woman tried for child-murder had made the praiseworthy attempt to restore a still-born child, although circumstances may show that she had cut its throat, severed its head, or strangled it, while circulation was going on! (See case, Prov. Med. Journal, April 23, 1845.) If compression be trusted to as a criterion, without a proper regard to other facts, a practitioner not used to such cases may undoubtedly be easily led into error; but he may be equally deceived if he trust what has been proposed as a substitute for compression—*i. e.*, a mere physical inspection of the lungs.

Improper objections to the hydrostatic test. Summary.—In concluding these remarks upon the objections to the hydrostatic test, it may be observed that medical practitioners have differed much at different times in their ideas of what it was fitted to prove. About fifty years ago, it would seem that this test was regarded by some as capable of furnishing evidence of murder! Thus we find Dr. Hunter asking the question, "How far may we conclude that the child was born alive, *and probably murdered by its mother*, if the lungs swim in water?" Later authorities, and, indeed, many in the present day, assert that the test is capable of proving whether a child has been *born alive* or not! From what has already been stated, as well as from the most simple reflection on the circumstances accompanying the birth of children, I think it must be evident that the hydrostatic test is no more capable of showing that a child has been *born alive or dead*, than it is of proving whether it has been murdered, or died from natural causes. The majority of those who have made experiments on this subject have only pretended to show, by the use of this and other tests, whether or not a child has *breathed*:—they merely serve to furnish in many cases good proof of life from the state of the lungs, and slight reflection will render it apparent that in no case are they susceptible of doing more. Even here, the utility is much restricted by numerous counteracting circumstances, a knowledge of which is essential to him who wishes to make a practical application of the facts connected with them. (See Ed. Med. and Surg. Jour. xxvi. 365.) If asked to state in what cases the pulmonary tests are capable of assisting a medical jurist, the answer, it appears to me, would be:—1st. They will clearly show that the newborn child has lived, when, during its life, it has *fully and perfectly respired*. Cases of this description form a certain number of those which come before our courts of law. To them, the most serious objections are not applicable; and the few which might be made to the medical inferences are not difficult to answer. 2dly. They will allow a witness to say, that the lungs must have either received air by respiration, or by artificial inflation. These are the cases in which a child has died soon after birth, and where the respiratory changes are but very imperfectly manifested in the lungs. They probably form the large majority of those that fall under the jurisdiction of the criminal law. It might be considered, that the qualification in the inference here drawn would neutralize its force; but

it must be remembered, that there are few instances of actual and deliberate child-murder, wherein artificial inflation could become even a possible defence for an accused party. So unusual is this kind of defence, that among the numerous trials for infanticide which have taken place in this country for many years past, I have not been able to meet with a single instance in which it was alleged, as an objection to the evidence derived from the buoyancy of the lungs, that the prisoner had inflated them in order to resuscitate her child. The reason is obvious: had such a defence been attempted, the whole of the circumstantial evidence would at once have set it aside. When, in the suspected murder of an adult, a medical man swears that a fatal wound was such that the deceased might have inflicted it on himself, or that the prisoner might have produced it, he is placing the jury in a very similar position to that in which he places them in a case of child-murder, when he says that the child might have breathed, or its lungs might have been artificially inflated. How would a jury decide in the two cases? Assuredly, by connecting certain facts with which a medical witness has no concern, but which may, in their opinion, satisfactorily supply the place of what is defective in his evidence. It is not for him to calculate the probabilities of respiration, or of artificial inflation; but it is for them to consider whether an accused party was or was not likely to have resorted to an experiment of this nature. It has been suggested that some person might inflate the lungs of a dead child, in order to raise a charge of murder against its mother; but this suggestion presupposes a profound knowledge of the difficulties of medical jurisprudence; and, even then, the question of *murder* does not happen to depend merely on the presence of air in the lungs. Such a case is very unlikely to present itself; indeed, its occurrence is no more probable than that in poisoning it should be considered a good defence, that some person might have introduced the poison into the stomach after death. The circumstances of the case will commonly furnish a sufficient answer to such hypothetical views.

The hydrostatic test ought not, therefore, to be lightly condemned, or rejected upon a speculative objection, which, in nine-tenths of the cases of child-murder, could not possibly exist. Let it be granted to the fullest extent, that a conscientious medical jurist cannot always draw a positive distinction between respiration and artificial inflation, still the jury may be in a situation to relieve him from the difficulty. In short, it would be as reasonable to contend that all murderers should be acquitted because homicidal are not always to be distinguished from suicidal wounds, as to argue that all cases of infanticide should be abandoned because these two conditions are not to be known from each other by any certain medical signs. If juries do frequently dismiss such cases, it is, I apprehend, to be ascribed rather to their great unwillingness to become the means of administering severe laws, than to their want of power to balance and decide on the probabilities laid before them. If the pulmonary tests were wholly set aside, it is easy to conceive what would be the consequences. Thus, let us suppose that a new-born child is found, under suspicious circumstances, with its throat cut; we are called upon to say, that it is impossible for medical evidence to establish whether the child had lived or not, and therefore we are to decline making an inspection of its body. But this would be the same as declaring that child-murder could never be proved against an accused party, and that new-born children might henceforth be destroyed with impunity! It appears to me, that conduct of this kind, on the part of a medical witness, would be wholly unwarrantable; for we may sometimes acquire, by an inspection, as great a certainty of respiration having been performed, and therefore of a child having lived, as of any other fact of a medico-legal nature. Cases of poisoning often give rise to greater difficulties to a medical jurist; as where, for example, he attempts to found his opinion of the cause of death on symptoms or post-mortem appearances. But we will put the question in this light. In the body of a healthy full-grown child, which has but recently died, we find the lungs filling the cavity of the chest, of

a light-red colour, spongy, crepitant beneath the finger, weighing at least two ounces, and when divided into numerous pieces, each piece floating on water after violent compression. Is it possible in such a case to doubt that respiration has been performed? If there be no certainty here, it appears to me that medical experience is but little fitted in any case to guide us in our inquiries. It would be difficult to point out an instance in which an affirmative medical opinion would be more surely warranted by the data upon which it was founded.

Respiration before birth.—It has been already stated that the pulmonary tests are only fitted to prove whether the child has or has not *lived to respire*. Neither the hydrostatic nor any other test can positively show that the child was entirely *born alive* when the act of respiration was performed. As this is a subject which generally gives rise to some discussion in cases of child-murder, I shall here make a few remarks on it:—1st, Respiration may be performed while the child is in the uterus, after the rupture of the membranes; the mouth of the child being at the os uteri. This is what is termed *vagitus uterinus;* its occurrence, although extremely rare, seems to me to rest upon undisputed authority. 2dly, A child may breathe while its head is in the vagina, either during a presentation of the head or the breach. This has been termed *vagitus vaginalis.* It is not very commmon, but it must be set down as a possible occurrence. 3dly, A child may breathe whilst its head is protruding from the outlet: in this position, respiration may be as completely set up in a few moments by its crying, as we find it in some children that have actually been born, and have survived their birth for several hours. This is the most usual form of respiration before birth. In the *vagitus uterinus or vaginalis*, the lungs receive but a very small quantity of air; in respiration after protrusion of the head, the lungs may be sometimes found moderately well filled; although never, perhaps, possessing all the characteristic properties of those which have fully respired. The well known occurrence of respiration under either of these three conditions strikingly displays the fallacy of making that process, as some have done, the certain criterion of uterine life. A child may breathe in the uterus or vagina, or with its head at the outlet, and die before its body is born: the discovery of its having respired would not, therefore, be any sort of proof of its having enjoyed what has been termed "extra-uterine life." (For a well marked case of this kind, see Med. Gaz. xxxviii. 304, and another communicated to me by Dr. Crothers, of Coy, will be found in Guy's Hospital Reports, Oct. 1850, p. 231.) The death of a child which has respired in the uterus or vagina from natural causes before its entire birth, is a possible occurrence; but its death from natural causes before birth, after it has breathed by the protrusion of its head from the outlet, is, I believe, a very unusual event. All that we can say is—it may take place; but its death, under these circumstances, would be the exception to a very general rule. Oberkamp, in four successive deliveries of the same female, observed that the children breathed before delivery, but died before they were born. A case of this kind also occurred at Diemerbroek. (See Meckel, Lehrbuch der G. M. p. 367; Beck's Med. Jur. 277; also, Ed. Med. and Surg. Jour. xxvi. 374.) The cases reported by Beck, of which there are three, lose much of their value from the fact that the lungs were not examined.

Respiration a sign of life, not of live birth.—The hydrostatic test is only capable of determining that *respiration has taken place:* it cannot show whether that process was established during birth, or afterwards. The fact of a child having the power of breathing before it is entirely born, does not therefore constitute the smallest objection to its employment; although, upon this ground, we find the use of it, in any case, denounced by many eminent men of the medical and legal professions. Thus, Archbold says, "Very little confidence is placed in this test as to the lungs floating, particularly if the child were dead any length of time before the experiment was made." (Criminal Pleading, 367.) Matthews speaks of the test as being "quite exploded." (Digest, 251.) And Jervis makes

the same remark. (On Coroners, 127.) It is obvious that most members of the law who have treated this subject, have adopted, without sufficient examination, the statements of Dr. William Hunter. This author observes: "A child will commonly breathe as soon as its mouth is born or protruded from the mother; and, in that case, may lose its life before its body be born, especially when there happens to be a considerable interval between what we may call the birth of the child's head and the protrusion of its body. And if this may happen where the best assistance is at hand, it is still more likely to happen when there is none—that is, where the woman is delivered by herself." (On the Uncertainty of the Signs of Murder in the case of Bastard Children, p. 33.) Dr. Hunter here exposes, in plain language, the fallacy of trusting to signs of respiration alone, as evidence of a child having been *born* alive. The truth of his remarks is, in the present day, generally admitted; and if, among medico-legal writers, we find some still treating of respiration as a certain proof of live birth, it is from their not having sufficiently considered the probability of a child breathing, and dying before its body is entirely extruded. But we may ask, How does the admission of these views affect a case of deliberate child-murder? A living and breathing child may be wilfully destroyed before its body is entirely born, as well as afterwards; and if the law of England does not contemplate the wilful destruction of a living and breathing child, before its entire birth, as a crime, this omission cannot be imputed as a fault to the medical jurist; nor can it at all diminish the real value of the hydrostatic test as furnishing indisputable evidence of *life*. Most persons might consider the crime of murder sufficiently made out, when the medical evidence showed that the child had lived, and that it was *living* when *criminally destroyed*. If, however, this do not constitute infanticide in law, and evidence be further insisted on, to set forth *where* the child was actually living when murdered—whether half protruding from the vagina, or altogether external to the body of the mother; then is the fact of respiration before birth an objection rather against the principles of the law, than against the tests used to determine the presence of life. In a case tried a few years since, in which a child had been found with a ligature firmly tied around its neck, the medical evidence showed, clearly, that it had breathed; and the whole of the appearances in its body were such as to leave no medical doubt that it had died by strangulation. The judge, in charging the jury, said, "If they were of opinion that the prisoner *had strangled her child before it was wholly born, she must be acquitted of the murder!*" The prisoner was acquitted. However we may regard the question of the utility of pulmonary tests, we cannot but look upon that law as but very imperfectly adapted to its purposes, which makes the proof of murder to rest, not upon the actual and wilful destruction of a living child, but upon the precise moment which a murderer may select for the accomplishment of the crime. Impunity is thus held out to all offenders, who destroy living children in the act of birth; but there is an additional evil, accompanying the operation of this legal rule, which seriously affects the medical evidence given on these occasions. It would seem, from cases to be presently related, that the law will assume, until the contrary appear from other circumstances, that the respiration of a child, if proved by the best evidence, was carried on before it was entirely born. Let the witness, then, in a case of alleged infanticide, ever so clearly establish the fact of respiration, and therefore of life, at the time the violence was used, this evidence is not sufficient. He is asked whether he will depose that the child had breathed after its body was entirely in the world. Unless he can make this deposition—which, for obvious reasons, he can rarely be in a condition to do—it will be presumed that, although the child had breathed, it came into the world dead. In this way, we perceive, a shield is effectually thrown around those who may have been really guilty of destroying their children immediately after birth. Under any moral consideration of the circumstances, I think it impossible to admit, that a woman who kills her child in the act of birth is less guilty of mur-

der than she who chooses the moment of its entire expulsion to destroy it;—such distinction, carried to its full extent, must virtually go to the entire abrogation of the law. It is quite necessary that medical witnesses should know what they are required to prove on these occasions; and the following cases will perhaps, serve to place this matter in a clear light.

The killing of children which breathe during birth, not child-murder.—In the case of *Rex* v. *Poulton*, good medical evidence was given to show that the child was living when the violence was offered to it. Of three medical witnesses, who were called, the first said, in answer to questions put to him: It frequently happens that the child is born as far as the head is concerned, *and breathes*, before death takes place before the whole delivery is complete. My opinion in this case is, that the child had breathed, but I cannot take upon myself to say, that it was wholly born alive. The second said that death might have occurred when the child was partly born, if no medical man was present to assist in the delivery. The third witness said,—It is impossible to state when the child respired; but there is no doubt, from the condition of the lungs, when they were examined, that the child had breathed: children may breathe during birth. (Chitty, Med. Jur. 412.) The evidence here given shows that the witnesses were intelligent men, and that they had duly reflected upon what the hydrostatic test is really capable of proving. The judge held that this medical evidence was not sufficient. "Something more was required than to show that a child had respired in the progress of its birth; it must be proved that the *whole body* of the child was brought into the world." (See Matthew's Digest, Supp. 25; also, Archbold, Crim. Plead. 367.) In the case of *Rex* v. *Simpson*, tried at Winchester, in March, 1835, Baron Gurney would not allow the case to proceed against the prisoner, so soon as the medical witness stated that the lungs of a child might become distended by the act of respiration during birth. In *Rex* v. *Brain*, it was held that the child must be wholly in the world in a living state to be the subject of murder; and in that of *Rex* v. *Sellis* (Norfolk Spring Circuit, 1836,) Mr. Justice Coltman held, that to justify a conviction for child-murder, the jury must be satisfied that the entire body of the child was actually in the world in a living state, when the violence was offered to it. But Mr. Baron Parke has pronounced a more decided opinion on this point, than any of the other judges. In relation to an important case of infanticide, tried at the Herts Lent Assizes, 1842, (see Guy's Hospital Reports, April, 1842,) he thus charged the grand jury: "With respect to all these cases (of infanticide,) there is a degree of doubt whether the infant has been *born* alive. The law requires that this should be *clearly proved*, and that the whole body of the child should have come from the body of the parent. If it should appear that death was caused *during delivery*, then you must not find a true bill!" On a more recent occasion (*Reg.* v. *Christopher*, Durham Lent Assizes, 1845,) Mr. Justice Erle drew a distinction between medical (physiological) and *legal* life. The medical evidence clearly established that the child had respired. It was found with its head nearly severed from the body. Mr. Justice Erle told the jury, that before they returned a verdict of Guilty, they must be satisfied the child was completely born, that it had an existence distinct *and independent from the mother*, and that it was murdered by her. It was possible the child might have respired without being completely born into the world, and although *this might medically be a live child, it was not one legally*. In law, the birth of the child must be complete. The jury acquitted the prisoner. (Prov. Med. Jour. April 23, 1845.)

From these decisions it will be seen, that it is not sufficient for a medical witness to declare, from the state of the lungs, that the child was alive *at or about* the time of its birth: according to the present view of our judges, it is indispensably necessary for him to prove that the child was *born* alive, or that it was living *after* its body had *entirely* come into the world.

Conclusions.—The general conclusions respecting the employment of the hydrostatic test, to be drawn from the contents of this chapter, are—

1. That the artificial inflation of the lungs of a child born dead will cause them to float in water.

2. That while lying in the chest, the fœtal lungs are not easily inflated, and that the difficulty of inflating them is great in proportion as the child is immature.

3. That lungs artificially inflated in situ resemble those organs in which respiration has been only imperfectly established.

4. That in cases of inflation in situ, hitherto tried, the air may be so far expelled from the divided portions of lung by firm compression, as to cause them to sink.

5. That the same result occurs with lungs in which respiration has been imperfectly established.

6. That when lungs have undergone perfect respiration the air cannot be expelled by compression of the divided parts, so as to cause them to sink.

7. That the artificial inflation of fœtal lungs causes no alteration of weight, and as the weight increases in proportion to the degree of respiration, so in healthy lungs, with great buoyancy, there should be great weight if the air have been derived from respiration.

8. That while respiration increases the absolute weight of the lungs, it diminishes their specific weight by leading to the distention of the pulmonary cells with air.

9. That when the lungs are very heavy, and contain but little air, it cannot with certainty be inferred that respiration has been established. The facts, cæteris paribus, may be explained by supposing that the lungs have been artificially inflated.

10. That we should base our judgment of a child having breathed, upon great weight and great buoyancy of the lungs combined,—that the one condition without the other is open to the objection, that the air may not have been derived from respiration.

11. That experiments on fœtal lungs, artificially inflated with air after removal from the chest, have no practical bearing on this inquiry.

12. That the floating of the lungs in water proves, cæteris paribus, that a child has breathed either at, during, or after birth; it does not prove that the child was born alive, or that it has died a violent death.

13. That the sinking of the lungs as a result of the expulsion of air from them by compression, does not prove that the child was born dead. It merely proves that the air contained in them was derived either from artificial inflation, or from the imperfect establishment of the respiratory process.

14. That the hydrostatic test is not applicable to determine the fact of respiration or non-respiration in all cases of infanticide; but that with ordinary precautions, it may be safely employed in the majority of such cases.

15. That a child may breathe before, during, or after birth, but the hydrostatic test will not enable us to say, in the greater number of cases, at which of these periods the act of respiration was performed.

16. That respiration is a sign of life, and not necessarily of live birth.

17. That according to the present state of the law, the killing of a child which breathes *during birth* is not murder.

18. Hence medical evidence is required to show whether the child breathed after it was *entirely* born; and whether the act of violence which caused its death was applied to it while so breathing.

These conclusions are here, for the sake of clearness, expressed with brevity. Some of them may appear to require qualification; but for the circumstances which qualify them, the reader is referred to the contents of the chapter.

CHAPTER XLII.

ON THE PROOFS OF A CHILD HAVING BEEN BORN ALIVE—EVIDENCE FROM RESPIRATION—EVIDENCE FROM MARKS OF VIOLENCE—EVIDENCE FROM NATURAL CHANGES IN THE UMBILICAL VESSELS, THE FORAMEN OVALE, AND DUCTUS ARTERIOSUS—CLOSURE OF THE FORAMEN AND DUCT BEFORE BIRTH—EVIDENCE FROM THE DISCOVERY OF FOOD IN THE ALIMENTARY CANAL—DETECTION OF LIVE BIRTH BY THE APPLICATION OF CHEMICAL TESTS TO THE CONTENTS OF THE STOMACH—DEFECTIVE EVIDENCE—GENERAL CONCLUSIONS.

THE great question on a trial for child murder is, whether the child has been born alive, and in order to answer this, it is necessary to consider what are the proofs of live birth which are available to the medical witness.

Evidence from respiration.—As a general rule there will be no perceptible difference in the state of the lungs, whether the act of respiration be performed by the child during parturition or after it is born, provided its death speedily follows its birth. But should we find that this process had been *perfectly established, i. e.* that the lungs present all those conditions which have been described as characteristic of full and perfect respiration, there is great reason to presume, that the process, even if it commenced during birth, must have continued after the child was entirely born. This presumption becomes still stronger, when the child is immature; for generally speaking, such children must be born and continue to respire for many hours after birth, in order that their lungs should present the characters of complete respiration. The process is seldom so established before birth as to give to these organs the feeling of crepitation under pressure: the existence of this character should, therefore, be sought for. A witness who relied upon it as a conclusive proof of respiration *after* birth, might be asked by counsel, whether it were not possible for some children to remain so long at the outlet with the head protruding, as to render the lungs crepitant from frequent respiration *before* entire birth. Admitting the bare possibility of this occurrence, he should endeavour to ascertain whether there were any probable causes thus to protract delivery, while the head of the child was in this position; as also what natural cause could have produced its death when its head was protruding, and when respiration had been so freely performed as to give crepitation to the lungs. The presence of the usual scalp-tumour might throw some light upon the case. If it did not prove live birth, it might indicate protracted delivery, and show that the child had been recently living.

Evidence from marks of violence.—If marks of violence apparently inflicted about the same time be found on different and remote parts of the body, and these marks bear the characters of those produced during life, it is rendered probable that the whole of the body of the child was in the world, when they were caused. Marks of severe violence on one part, as the head or breech, would not always justify such a presumption, because it might be fairly objected that they had been unintentionally produced by the woman in her attempts at self-delivery, and yet the child not have been born alive. It would be for a witness to form an opinion from the circumstances accompanying the particular case, whether they had been thus occasioned. From this it will be seen that in making a post-mortem examination, it is proper that every mark of injury on the body of a child should be noted down. In March, 1848, I was consulted by Mr. Prince, a former pupil, in reference to a very interesting case in which the presumption of live birth rested mainly on the degree of respiration, and the position and nature of certain marks of violence found on the child's body. The child, which was said to have been born dead, was exhumed two days after burial, and eleven days after birth,

and the body examined by Mr. Prince. It was full grown, and not putrefied; the skin pale, and free from lividity. There was a clean cut on the right arm, dividing the fascia and muscles, as if made by a sharp instrument. The edges were much retracted, and the whole of the wound was of a florid red colour; but there was no swelling or other marks of inflammation. There was a large vesicle (like the vesication of a burn) on the scrotum, containing three drachms of yellow-coloured serum. On the right leg the muscles and fascia were exposed for nearly the whole length; the surface of the wound was of a deep scarlet colour, and the margin widely inflamed. It had the appearance as if fire had been applied to the leg, although there was no sign of charring. These facts tended to show that the child was living when the injuries were inflicted, and their nature and situation rendered it impossible that they could have arisen from any accident during delivery. The state of the lungs was somewhat remarkable,—the *left* floated freely in water, and there was distinct crepitation in it; the right sank in water,—no portion of it when divided was observed to float. From the very buoyant and crepitant state of the left lung, there was reason to presume that if respiration had commenced during birth, it had continued afterwards. Mr. Prince therefore inferred that the child had been born alive:—this inference was corroborated by the appearance of the marks of violence. It is probable that the child did not live long after birth. The air could not have been derived from putrefaction or artificial inflation; therefore the only question here was, whether the child had breathed after its body was wholly in the world. The facts above mentioned justified the inference drawn by Mr. Prince. From a confession subsequently made by the female, it appeared that the child had been born alive, and had cried, but owing to the injuries inflicted on it, it did not survive birth longer than a quarter of an hour.

Although it is a rare circumstance that one lung should become thus fully distended with air, while the other receives none, cases of this kind are on record. Chaussier met with the *left* lung much more distended than the right in the bodies of children which had survived birth some hours. (Capuron, Méd. Lég. des Accouchemens, 411.) The general opinion is, that the right lung receives air more readily than the left, owing to the size and direction of the right bronchus.

Evidence from certain changes in the body.—In a child which has been born alive, or which has survived its birth, that portion of the umbilical cord which is contiguous to the abdomen undergoes certain changes:—thus it becomes slowly corrugated, and separates with or without cicatrization. The umbilical vessels become at the same time gradually closed. According to Billard, the obliteration of these vessels is effected in a peculiar way. The caliber diminishes as a result of the concentric enlargement of the coats, so that while the vessel retains its apparent size, its cavity becomes gradually blocked up. A quill would represent the form of the vessel in the fœtal state, and a tobacco-pipe in the obliterated state. It is only by cutting through the vessel that the degree of obliteration can be determined.

The state of the *umbilical cord* has often furnished good evidence of live birth, when the other circumstances of the case were inadequate to furnish decisive proof. In the following case, for the particulars of which I am indebted to Mr. French, it might have been suspected, but for the state of the cord, that the child had been still-born, and that its lungs had been artificially inflated. The body of the child had been exhumed soon after burial, in consequence of some suspicion respecting the cause of death. It weighed nearly five pounds, and was eighteen inches long; the opening for the navel was exactly in the centre of the body. The hair on the scalp was about an inch in length, and plentiful; the nails reached to the extremities of the fingers and toes. There was no mark of violence about it. The *navel-string had separated* by the natural process, but the skin around was not quite healed. The tendon of the tibialis anticus was

prominent, and apparently contracted at the instep. The left testicle alone descended into the scrotum,—the right was still in the inguinal canal. rendered it probable that the child had not quite reached maturity. It was this peculiarity of the instep that the child was identified. In the first instance a different child had been brought from the same burial-ground, but rejected from the absence of this appearance of the foot. On opening the chest, lungs were observed to be situated posteriorly, and not filling the cavity. They weighed together 861 grains—the right weighing 430, and the left 431 grains. The heart, thymus, and lungs, were placed together in water, but they immediately sank to the bottom. The lungs, when separated from the other organs, floated, but with a very slight degree of buoyancy. Indeed, this was established by the fact that they sank with the heart and thymus attached. The lungs were cut into twenty-two pieces—three from the apex sank; the remaining nineteen pieces floated, nor were they made to sink on pressure. The foramen ovale was but slightly open and contracted, as well as the ductus arteriosus, to about one-half of the fœtal diameter. The bladder was perfectly empty,—the intestines contained only mucus. The conclusions at the inquest were:—1. That the child had been born alive, and had lived certainly not less than three days and probably longer.—2. That respiration during that time had been but perfectly established.—3. That in all probability it had died a natural death. The conclusions were well warranted by the medical facts. Experiments on the lungs were here not absolutely necessary, owing to the state of the umbilical cord. It might have been objected to any inference from the condition of the organs, that the facts were explicable on the supposition of their having been artificially inflated. This case, therefore, furnishes another proof of the error with which a speculative objection, on this ground, may be set aside. It was subsequently proved that the child had lived eight days after birth.

These changes in the umbilical cord, when found, clearly prove that a child has survived its birth, whatever may be the results of experiments on the lungs; but the difficulty is, that they require some days for their development, and in practice it is often necessary to procure some sign of survivance for only a *few minutes*, or at farthest of a *few hours*. The same remark applies to the *exfoliation of the cuticle* in a new-born child: such a condition of the skin can very rarely be found in cases of infanticide. The absence of meconium from the intestines, and of urine from the bladder, are not proofs of live birth, for these may be discharged during birth, and yet the child not be born alive.

Evidence from changes in the heart and fœtal vessels. Docimasia circulatoria.—It has been supposed that the state of the foramen ovale, ductus arteriosus, and canalis venosus, would aid a medical jurist in forming an opinion whether a child had survived its birth. In general, as a result of the establishment of respiration, it is found that the communication between the auricles of the heart by the foramen ovale becomes closed; and that the two vessels, after gradually contracting, become obliterated or are converted into fibrous cords. Whatever may be the results of experiments on the lungs, it has therefore been contended, that the closure of the foramen and vessels would infallibly indicate that the child had breathed. This inference, however, has been too hastily drawn. Recent researches have shown, that there are some most serious objections to any conclusions based on the state of the fœtal vessels. The entire closure of these parts, as a natural process, always takes place slowly, and sometimes it is not complete even many years after birth. Thus, then, in the generality of cases of infanticide, in which necessarily the child survives but for a very short period, no evidence of the fact will be procurable by an examination of the heart and fœtal vessels.

Ductus arteriosus.—Prof. Bernt, of Vienna, who has made many observations on this subject, has come to the following conclusions respecting the period required for the closure of the ductus arteriosus in children which have lived after birth:—1. If the child has lived only a *few seconds*, the aortal end of the duct

contracted, and the vessel, instead of being cylindrical throughout, ac-
the form of a truncated cone.—2. If the child has lived for *several hours*,
ole day, the duct becomes again cylindrical, although shortened and con-
in diameter. Its size is about equal to a goose's quill: it is, therefore,
maller than its root, and about as large as either of the two branches of
monary artery, which have, in the mean time, become increased in size.
f the child has lived for *several days* or a *whole week*, the duct contracts
iameter of a few lines,—about equal to a crow-quill, while the two branches
ulmonary artery are equal in size to a goose's quill.—4. The duct is met
rfectly closed, and quite impervious, at a much later period; *i. e.* after
e of a very uncertain number of weeks or even months. Among the ex-
l conditions, Bernt remarks, that the contraction may be first observed
rdiac instead of the aortal end. In one instance of a still-born child,
s resuscitated and breathed feebly for a short time, and in which the
land was absent, the duct was found of the size of a crow-quill, as in
which have lived several days. He also states, on the authority of
allgruber, that the duct is sometimes entirely absent. (Das verfahren
ichtlich-medicinischen Ausmittelung Zweifelhafter Todesarten der
, von Joseph Bernt, S. 67, Wien, 1826; also, Systematisches
r gerichtlichen Arzneikunde, S. 275, Vierte Auflage, Wien, 1834.)
given the conclusions of Professor Bernt, in order to show that
ure of the duct is a very slow process; but the conclusions are
more exceptions than those admitted by the writer. Neither in
those of other authorities on medical jurisprudence, is any case
hows that the duct can become quite impervious from natural
which has lived only a few hours.
losure may take place as a result of the establishment of respi-
s that the time of its occurrence after birth is so uncertain as
nce derived from the non-closure altogether fallacious. I have
lies of several children which have survived birth for some
t been able to discover any perceptible alteration in the dia-
ither at its aortal or cardiac end. In other cases partial con-
pparent. As the closure depends on a diversion of blood
so it follows, that when respiration is feeble or imperfect, the
either of its natural potency, or, if closed, the closure must
abnormal deviation. In the case of a child which died at the
the ductus arteriosus was found to be freely open. (Med. Gaz.
esearches of Dr. Norman Chevers have shown that there are
nal conditions which may give rise to non-occlusion of the duct.
v. 187, and xxxviii. 961: see also, Orfila, Méd. Lég. 1848, ii.
he numerous facts collected by Dr. Chevers, it would appear that
le to become contracted and even obliterated, before birth, and
ld has breathed. In these cases there has been, in general, some
dition of the heart or its vessels; but this, even if it exist, might
l in a hasty examination: hence the contracted or closed condition
annot be taken as an absolute proof that the child has been born
rvived its birth. In January, 1847, Dr. Chevers presented to the
thological Society the case of a child born between the seventh and
nth, in which this vessel was almost closed, being scarcely one-twelfth
in diameter, and capable of admitting only the shank of a large pin.
es of the duct had altogether rance of having undergone a
of contraction, and its that its closure commenced
In fact, the ch nly *fifteen minutes;* while,
le, the medica ght have been that the child
is important t in this case the heart and
led. Gaz. xx

The value of these facts, in a medico-legal view, will be apparent from a case recently tried in Scotland, in which the proof of live birth rested chiefly upon a closed condition of the arterial duct. (*Reg.* v. *Frith*, Ayr Circ. Court of Justiciary, Oct. 1846.) The body of a child was found concealed in a bag, and buried just below the surface of the ground. The prisoner, who it was proved had been delivered of a child about three weeks before, was charged with the murder. The circumstances against her were chiefly of a presumptive kind, and the most material medical question was, whether the deceased child had come into the world alive. When found, the body was slightly putrefied. The following is a detailed account of the appearances, from the report of the examiners:—"On inspecting the body externally, we found it in a state of putrefaction, with desquamation of the cuticle. It weighed five pounds, and was twenty inches in length. Its mouth and nostrils were stuffed with flax. The umbilicus was in the centre of the body, the cord cut close to the abdomen, and left without a ligature. The scalp was covered with hair, and the nails were full grown. There was an extensive ecchymosis all over the fore part of the neck, and an effusion of blood on the exterior aspect of the trachea. The heart and lungs weighed one ounce: the latter organs were collapsed. The right lung was considerably decomposed, and sank when put in water: the left was of a red colour, firm in texture, and floated on the surface when immersed in a vessel filled with water; but on pressure there was no crepitation. The right side of the heart was filled with coagulated blood, the foramen ovale being partly open, and the ductus arteriosus impervious. The liver was large, and of a leaden hue, the ductus venosus almost obliterated, and the meconium found in abundance in the lower bowels. The reporters were of opinion, from the perfect conformation of the child's body, and the above mentioned appearances, that it had life at birth. The appearances met with they considered quite sufficient to account for death."

The circumstantial evidence established that not more than five hours could have elapsed from the birth of the child to the time at which its body was buried in the spot where it was subsequently found; and that, admitting it to have been born alive, there was the strongest reason to believe that it did not survive its birth *ten minutes*. The results of experiments on the lungs were insufficient to show that the child had been born alive. The organs were light, and not crepitant; the right lung was decomposed, and yet it sank in water, while the left was firm, and floated. The principal medical fact, then, in favour of live birth, was that the arterial duct was *impervious;* and it became a question, on the examination of the medical witnesses, whether this vessel could have been naturally closed within so short a period after birth, as that which was proved in this instance. Two of them stated that, in their opinion, the child had been born alive, but they had known of no instance in which the arterial duct had become so speedily closed after birth. In the defence, one medical witness deposed that, from an impervious duct, he should infer a survivance of at least twenty-four hours, and the other of four or five days. The prisoner was acquitted, on a verdict of Not proven. (Med. Gaz. xxxviii. 897; and Ed. Monthly Jour. Nov. 1846, 385.)

So far as I am aware, there is no instance on record of the arterial duct becoming *impervious* within the period of five or six hours after birth, as a result of free and perfect respiration in a healthy child; and therefore it is in the highest degree probable, that its impervious state, in this instance, was not the result of a natural process, but of some abnormal condition existing previously to birth,—a conclusion warranted by a case reported by Dr. Chevers. The facts that respiration had been most imperfectly performed, and that the child had been probably destroyed within a few minutes after its birth, are also strongly adverse to the view taken by some of the witnesses at the trial, that the occlusion of the duct was the result of the usual changes. Hence its condition could not safely be regarded as furnishing clear evidence of live birth. The only fact bearing on

this, was the deposition of one witness, that he slept in the next room to the prisoner, and heard what he thought was the cry of a child at the supposed period of her delivery.

Admitting that this abnormal state of the duct, *i. e.* its closure previous to birth is in general accompanied by malformation of the heart, or great vessels connected with it, yet a case already related proves that this is by no means a necessary accompaniment. Hence considering the very serious responsibility attached to a medical opinion in a case of child-murder, the better rule will be to place no confidence on a contracted condition of this duct as evidence of live birth. It can only have any importance as evidence, when the death of the child speedily follows its birth; and these are precisely the cases in which a serious fallacy is likely to arise, for the contraction or closure may be really congenital, and yet pronounced normal. If a child has lived for a period of two or three days (the time at which the duct naturally becomes contracted or closed,) then evidence of live birth from its condition may not be required: the fact of survivance may be sufficiently apparent from other circumstances. Hence this species of evidence is liable to prove fallacious in the only instance in which it is required.

Canalis venosus.—There is not, so far as I know, any instance of the obliteration of this vessel previous to birth. When respiration is fully established, it collapses, and becomes slowly converted, in a very variable period of time, to a ligamentous cord or band which is quite impervious. There is no doubt that in those cases where it is stated to have become obliterated in children which could have survived birth only a few minutes or hours, the collapse of the coats has been mistaken for an obliteration of the canal. It is probably not until the second or third day after birth that its closure begins, although nothing certain is known as to the period at which it is complete. The condition of this vessel, therefore, can throw no light upon those cases of live birth in which evidence of the fact is most urgently demanded.

Foramen ovale.—This aperture in general becomes closed after the establishment of respiration; but I have found it repeatedly open in children which had survived birth several hours; and, as it will be hereafter stated, the period of its closure is as variable as in the case of the ductus arteriosus. Hence it is not capable of supplying, with certainty, evidence of live birth, in those instances in which this evidence is required. According to Billard, the foramen becomes closed between the second and third days; but there are numerous cases in which it is found not closed at much later periods after birth. Dr. Handyside states that it is more or less open in one case out of eight. In 1838, two subjects were examined at Guy's Hospital, one aged fifty, the other eleven years, and in both the foramen was found open. There is, however, another serious fallacy, which has been only recently brought to light: the closure of the foramen ovale has been known to occur as an abnormal condition previously to birth and the performance of respiration. One case is mentioned by Capuron (Méd. Lég. des Accouchemens, p. 337,) and another, of a very instructive kind, is reported in the Medical Gazette (vol. xxxviii. 1076.) Other instances of this abnormal condition are adverted to by Dr. Chevers (Med. Gaz. xxxviii. 967,) and it would appear, that in these the arterial duct remained open, in order to allow of the circulation of blood not only before, but subsequently to respiration. The children rarely survive birth longer than from twenty to thirty hours. Dr. Chevers justly observes, that "cases of this description are of the highest importance in a medico-legal point of view, as they fully disprove the opinion maintained by many anatomists, that obliteration of the foramen ovale must be received as a certain evidence that respiration has been established. It is assuredly impossible to deny that in the heart of a child which has died within the uterus, and has been expelled in a putrid condition, the foramen ovale may be found completely and permanently closed. In such cases as these, it would, however, probably be

always possible to determine, by an examination of the heart and its appendages, that the closure of the foramen had occurred at some period or other anterior to birth." It would, therefore, be unsafe in practice to rely upon the closure of this aperture as proof of live birth, without other good evidence; and in no case can its patency be regarded as a proof that a child has come into the world alive.

As a general rule, these peculiar fœtal vessels are rarely obliterated by a normal process before the eighth or tenth day after birth. The obliteration, according to Bernt and Orfila, takes place in the following order:—1. The umbilical arteries.—2. The canalis venosus.—3. The ductus arteriosus, and 4. The foramen ovale. (Orfila, Méd. Lég. 1848, ii. 210.)

The result of this inquiry respecting Professor Bernt's *docimasia circulatoria* is essentially negative; it either proves nothing, or it may lead the medical witness into a fatal error. It has been the more necessary to point out the source of fallacies to which it is liable, because hitherto medical jurists have been disposed to place great reliance upon it, in cases where evidence from the state of the lungs was wanting. The necessity of these facts being known is shown by the case which occurred at Ayr (ante, p. 320,) in which great reliance appears to have been placed upon the following statement by Dr. Beck:—"If, therefore, *the ductus arteriosus be found cylindrical in its shape, and not contracted towards the aorta, and if it equal in size the trunk of the pulmonary artery*, the inference would be, that the child was not born alive. On the other hand, if *the ductus arteriosus* be contracted towards the aortal end, *and if its size be much less than the trunk of the pulmonary artery*, the inference would be, that the child had been born alive." (Beck's Med. Jur. 5th edit. p. 251.) From a consideration of the preceding facts, it will be seen that such inferences would be quite erroneous, and might seriously mislead a Court of Law.

Evidence from the state of the alimentary canal.—Good evidence of live birth may be sometimes derived from the discovery of certain liquids or solids in the stomach and intestines, such as blood, milk, or farinaceous or saccharine articles of food; for it is not likely that these substances would be introduced or swallowed during parturition, nor is it at all probable that they should find their way into the stomach or intestines of a child which was really born dead. In a case of a new-born child, Dr. Geoghegan discovered, by the application of iodine water, the presence of farinaceous food in the stomach; hence the question of live birth was clearly settled in the affirmative. In a still more recent case, Dr. Francis, of Manchester, employed this mode of testing, with satisfactory results, even where the investigation was beset with many unusual difficulties. He was required by the coroner to examine the body of a new-born child found under suspicious circumstances. The examination of the lungs left no doubt that respiration had taken place; and the fact that the child had been born alive, was fully established by the discovery in the stomach of a small quantity of farinaceous food. On digesting a fragment of the pulp found in this organ with distilled water, and adding a drop of a weak solution of iodine, an intense indigo blue colour appeared immediately. The application of this chemical test, therefore, removed any doubts which might have been entertained on the question of live birth. (Med. Gaz. xxxvii. p. 460.)

Sugar. In one case which I had lately to examine, the presence of sugar was easily detected in the contents of the stomach by the application of Trommer's test. In order to apply this test, a few drops of a very weak solution of sulphate of copper should be added to a portion of the concentrated aqueous extract of the contents of the stomach. An excess of a solution of caustic potash is then added, and the liquid boiled. If sugar be present, the sub-oxide of copper is immediately precipitated of a reddish-brown colour. With white sugar the same decomposition is effected, but more slowly. If starch be present, black oxide of copper may be thrown down, but there is no reduction. The production of the red oxide proves that some saccharine substance is present.

Milk. This liquid, or its principle, casein, forms a rich violet-blue solution with a few drops of a solution of sulphate of copper, and an excess of caustic potash. The red sub-oxide will be thrown down on boiling if sufficient *lactine* (sugar of milk) be present. Casein, or the curd of milk, acts in the same way. The decomposition takes place more slowly and is less perfect than with sugar.

Albumen forms a deep violet-blue solution with potash and sulphate of copper, but the red sub-oxide is not precipitated on boiling. Either there is no effect, or if the caustic potash be in large quantity, the black oxide falls down. An instance is related by Dr. Döring, where a spoonful of coagulated *blood* was found in the stomach of a new-born child. The inner surface of the œsophagus and trachea was also covered with blood. Dr. Döring inferred from these facts, that the child had been born alive; for the blood, in his opinion, must have entered the stomach by swallowing, after the birth of the child, and while it was probably lying with its face in a pool of blood. (See on this subject Henke's Zeitschrift, 1842, ii. 219.)

In forming a judgment in a doubtful case, a question may arise whether any and what kind of food naturally exists in the stomach of a fœtus born dead. This curious subject has been recently examined with great ability by Dr. George Robinson, of Newcastle-upon-Tyne, and I am indebted to that gentleman for the subjoined conclusions. His observations were made on the stomachs of two human fœtuses, and on those of the calf, lamb, and rabbit. His conclusions are: —1. That the stomach of the fœtus, during the latter period of its uterine existence, invariably contains a peculiar substance, differing from the liquor amnii, and generally of a nutritious nature. 2. That in its physical and chemical properties, this substance varies very much in different animals, being in no two species precisely similar. 3. That in each fœtal animal the contents of the stomach vary much at different periods; in the earlier stages of its development, consisting chiefly of liquor amnii, to which the other peculiar matters are gradually added. 4. That the liquor amnii continues to be swallowed by the fœtus up to the time of birth; and consequently after the formation of those matters, and their appearance in the stomach. 5. That the mixture of this more solid and nutritious substance with the liquor amnii, constitutes the material submitted to the process of chymification in the fœtal intestines. He considers the contents of the alimentary canal to be chiefly derived from the salivary secretion. It is his opinion that there is no gastric juice secreted until respiration is established. The medical jurist will perceive, therefore, that the discovery of farinaceous food, milk, or sugar in the stomach, will furnish evidence of live birth; since substances of this kind are never found in the fœtal stomach.

Defective evidence.—The slightest consideration will show that the signs of live birth above described are weak, and of purely accidental occurrence. If the child be destroyed during birth or within a few minutes afterwards, there will be no medical evidence to indicate the period at which its destruction took place. The external and internal appearances presented by the body would be the same in the two cases. It is most probable that in the greater number of instances of child-murder, the child is actually destroyed during birth, or immediately afterwards; and, therefore, the characters above described can rarely be available in practice. If any exception be made, it is with respect to the nature, situation, and extent of marks of violence; but the presence of these depends on mere accident. Hence, then, we come to the conclusion, that although medical evidence can often show, from the state of the lungs, that a child has really lived, it can very rarely be in a condition to prove in a case of infanticide that its life certainly continued after its birth. We could only venture upon this inference when the signs of respiration were full and complete, or food was found in the stomach. Why the destruction of a child should be treated in the one case as a venial offence, and in the other as a capital crime, is one of those anomalies in our criminal jurisprudence for which it is impossible to account. The inference which

we may draw from these observations is, that if positive proof of *entire live* be in all cases rigorously demanded of medical witnesses on trials for child-murder, it is scarcely possible, when the prisoner is ably defended, that any conviction for the crime can take place. The only exception would be, where a confession was made by the accused, or the murder was actually perpetrated before eye-witnesses. The numerous acquittals that take place on trials for this crime in face of the strongest medical evidence, bear out the correctness of this opinion. The child is proved to have lived and breathed, but the medical evidence fails to show that the living and breathing took place or continued after *entire* delivery. [For some judicious remarks on this defective state of the law, see Prov. Journ. April 2, 1851, p. 182.]

Conclusions.—The general conclusions which may be drawn from the facts contained in this chapter, on the question whether a child has or has not been *born alive*, are as follow:—

1. That if the lungs be fully and perfectly distended with air by the act of respiration, this affords a strong presumption that the child has been *born* alive, since respiration during birth is in general only partial and imperfect.

2. That the presence of marks of severe violence on various parts of the body, if possessing vital characters, renders it probable that the child was entirely born alive when the violence was inflicted.

3. That certain changes in the umbilical vessels, and the separation by a vital process and cicatrization of the umbilical cord, as well as a general exfoliation or desquamation of the cuticle, indicate live birth.

4. That the absence of meconium from the intestines, and of urine from the bladder, are not proofs that a child has been entirely born alive, since these liquids may be discharged during the act of birth.

5. That the open or contracted state of the foramen ovale or ductus arteriosus furnishes no evidence of a child having been born alive. These parts may become closed and contracted *before birth*, and therefore in a child born dead; or they may remain open after birth in a child born living, even after the establishment of respiration.

6. That the presence of farinaceous or other food in the stomach proves that a child has been entirely born alive.

7. That irrespective of the above conclusions, there is no certain medical sign which indicates that a child, which may have died at or about the time of birth, has been *entirely* born alive.

CHAPTER XLIII.

RULES FOR DETERMINING THE PERIOD OF SURVIVANCE IN CHILDREN THAT HAVE BEEN BORN ALIVE. APPEARANCES INDICATIVE OF A CHILD HAVING LIVED TWENTY-FOUR HOURS—FROM TWO TO THREE DAYS—FROM THREE TO FOUR DAYS—FROM FOUR TO SIX DAYS—FROM SIX TO TWELVE DAYS. UNCERTAINTY OF MEDICAL EVIDENCE. ON THE PERIOD WHICH HAS ELAPSED SINCE THE DEATH OF THE CHILD. PROCESS OF PUTREFACTION IN THE BODIES OF NEW-BORN CHILDREN. GENERAL CONCLUSIONS.

If we suppose it to have been clearly established, that the child not only lived but was actually *born* alive, it may be a question whether it lived for a certain number of hours or days after it was born. The answer to this question may be necessary in order to connect the deceased child with the supposed mother. It has been remarked that scarcely any appreciable changes take place in the body of a living child, until after the lapse of twenty-four hours; and these changes

may be considerably affected by its degree of maturity, healthiness, and vigour. The following may be taken as a summary of the appearance of a child which has survived its birth for different periods:—

1. *After twenty-four hours.*—The skin is firm and pale, or less red than soon after birth. The umbilical cord becomes somewhat shrivelled, although it remains soft and bluish-coloured, from the point where it is secured by a ligature, to its insertion in the skin of the abdomen. The meconium is discharged; but a green-coloured mucus is found on the surface of the large intestines. The lungs may be more or less distended with air, although in a case of survivorship for a period longer than this, no trace of air was found in them. With regard to the state of the lungs, it should be remembered, that when these organs are fully and perfectly distended, the inference is that the child has probably survived many hours; but the converse of this proposition is not always true. Several cases, already reported, show that where the lungs contain a very small quantity of air, it does not follow that the child must have died immediately after it was born.

2. *From the second to the third day.*—The skin has a yellowish tinge,—the cuticle sometimes appears cracked, a change which precedes exfoliation or desquamation. (Devergie, i. 519.) The umbilical cord becomes brown and dry between the ligature and the abdomen.

3. *From the third to the fourth day.*—The skin is more yellow, and there is evident exfoliation of the cuticle on the chest and abdomen. The umbilical cord is of a brownish-red colour, flattened, semi-transparent, and twisted. The skin in contact with the dried portion presents a ring of vascularity or redness;—but Dr. Geoghegan met with this appearance in two cases of still-born children, and I have also seen it in four cases where the children were born dead. (G. H. Rep. April, 1842.) The colon is free from any traces of green mucosity.

4. *From the fourth to the sixth day.*—The cuticle in various parts of the body is found separating in the form of minute scales or of a fine powder. The umbilical cord separates from the abdomen usually about the *fifth day*, but sometimes not until the eighth or the tenth. The membranous coverings become first detached, then the arteries, and afterwards the vein. If the umbilical aperture is cicatrized and *healed*, it is probable that the child has lived from three weeks to a month after birth. The ductus arteriosus may be found contracted both in length and diameter: the foramen ovale may be also partly closed.

5. *From the sixth to the twelfth day.*—The cuticle will be found desquamating on the extremities. If the umbilical cord was small, cicatrization will have taken place before the tenth day after birth. If large, a sero-purulent discharge will sometimes continue for twenty-five or thirty days. The ductus arteriosus is said to become entirely closed during this period; but this statement is open to exceptions which have been elsewhere pointed out. It need hardly be observed that the body rapidly increases in weight when the child has enjoyed active existence.

On the whole, it will be seen that the signs of survivorship for short periods after birth are not very distinct. There is commonly no difficulty in determining the fact after the second day. The changes stated to take place in the umbilical cord during the first twenty-four hours, may be observed in the *dead* as well as in the living child; and the other changes occur with much uncertainty as to the period. These are, however, I believe, the principal facts upon which a medical opinion on such a subject can be based, and it is in some respects fortunate, that great precision in assigning the time of survivorship is not demanded of medical witnesses.

Putrefaction in the new-born child.—A practitioner may be further required to state *how long a period has elapsed since the death of the child.* The answer to the previous question was derived from the changes which take place in the body of a child during *life*, while, in relation to the present inquiry, we must

look to those which occur in the body after *death;*—in other words, to the different stages of putrefaction. From the observations of Orfila, it would appear that the body of an infant putrefies more rapidly than that of an adult. (Traité des Exhumations.) In forming a judgment on this point, due allowance must be made for the influence of temperature, humidity, and the free access of air. If the body has been sunk in water, putrefaction takes place more slowly than usual, and the process is slower in running than in stagnant water. When the body is floating on the surface of water, so as to be at the same time exposed to air, then putrefaction takes place very rapidly;—and this also happens when the body, after removal from water, has been exposed to the air for some time. Putrefaction is also retarded when the deceased child has been buried in the ground in a box or coffin, unless the process had already commenced prior to interment. When the body has been cut up and mangled before being thus disposed of, putrefaction takes place with much greater rapidity. (The *Queen* v. *Railton*, Stafford Winter Assizes, 1844.)

Conclusions.—The general conclusions respecting survivorship are:—

1. That the period for which a new-born child has survived birth cannot be determined by any certain sign for the first twenty-four hours.

2. That after this period, an inference may be drawn from certain changes which take place progressively in the skin and umbilical cord externally, and in the viscera on inspection;—that these changes allow only of an approximate opinion within the first five or six days.

3. That the contraction of the foramen ovale and ductus arteriosus takes place from natural changes at such uncertain intervals, as to render it difficult to assign a period of survivorship from the state of these parts.

4. That the period which has elapsed since the child died, after it was born, can only be determined by observing the degree of putrefaction in the body compared with temperature, locality, and other conditions to which it has been exposed.

CHAPTER XLIV.

CAUSES OF DEATH IN NEW-BORN CHILDREN—PROPORTION OF CHILDREN BORN DEAD—NATURAL CAUSES OF DEATH—A PROTRACTED DELIVERY—DEBILITY—HEMORRHAGE—LACERATION OF THE CORD—COMPRESSION OF THE CORD—MALFORMATION—DESTRUCTION OF MONSTROUS BIRTHS ILLEGAL—DEATH FROM CONGENITAL DISEASE. GENERAL CONCLUSIONS.

Causes of death in new-born children.—The next important question in a case of infanticide, and that upon which the charge of murder essentially rests, is—what was the cause of death? 1. It is admitted that a child may die during birth or afterwards. 2. In either of these cases it may die from *natural or violent causes.* The violent causes may have originated in *accident* or in *criminal design.* The last case only involves the corpus delicti of child-murder. If death has clearly proceeded from natural causes, it is of no importance to settle whether the cause operated during or after birth:—all charge of criminality is thereupon at an end.

Proportion of children born dead.—It is well known that of children which are born under usual circumstances, a great number die from natural causes either during birth or soon afterwards; and in every case of infanticide, death will be presumed to have arisen from some cause of this kind, until the contrary appear from the evidence. This throws the onus of proof entirely on the prosecution. Many children die before performing the act of respiration; and thus a

large number come into the world still-born or dead. The proportion of *still-born* among legitimate children, as it is derived from statistical tables extending over a series of years, and embracing not less than eight millions of births, varies from one in eighteen to one in twenty of all births. (B. and F. Med. Rev. No. vii. 234.) Dr. Lever found, out of three thousand births, that one in eighteen was born dead. In immature and illegitimate children, the proportionate mortality is much greater,—probably about one in eight or ten. In Göttingen the deaths were found to amount to one in seven, and in Berlin to one in ten. (Ed. Med. and Sur. Jour. xxxvi. 172.) Males are more frequently born dead than females, in the ratio of 140 : 100,—while the males to females born, has only a ratio of 106 : 100. (Dr. Simpson, Ed. Med. and Sur. Jour., Oct., 1844, 395.) The preponderance of still-births among males is ascribed to the large size of the head, and the injury thus likely to be inflicted on the brain during parturition. Still-births are much more frequent in first than in after pregnancies. These facts should be borne in mind, when we are estimating the probability of the cause of death being natural. Should respiration be established by the protrusion of the child's head from the outlet, or the birth of its body, the chances of death from natural causes are considerably diminished. Nevertheless, as Dr. Hunter long ago suggested, a child may breathe and die. Thus, according to this author,—"If the child makes but one gasp and instantly dies, the lungs will swim in water, as readily as if it had breathed longer and had then been strangled." In general, it would require more than one gasp to cause the lungs to swim readily in water; but waiving this point, the real question is,—if the child breathed after birth, what could have caused its death? The number of gasps which a child may make, or which may be required for the lungs to swim in water, is of no moment:—the point to consider is, whether its death was due to causes of an accidental or criminal nature. So again observes Dr. Hunter: "We frequently see children born, who from circumstances in their constitution or in the nature of the labour, are but barely alive, and after breathing a minute or two, or an hour or two, die, in spite of all our attention. And why may not this misfortune happen to a woman who is brought to bed by herself?" (Op. cit.) The substance of this remark is, that many children may die naturally after birth; and in Dr. Hunter's time, these cases were not perhaps sufficiently attended to. In the present day, however, the case is different:—a charge of child-murder is seldom raised except in those instances where there are the most obvious marks of severe and mortal injuries on the body of a child; and unless it be intended to defend and justify the practice of infanticide, it must be admitted that the discovery of violence of this kind on the body of a new-born infant, renders a full inquiry into the circumstances necessary. Among the *natural causes* of the death of a child, may be enumerated the following:—

1. *A protracted delivery.*—The death of a child may proceed, in this case, from injury suffered by the head during the violent contractions of the uterus, or from an interruption to the circulation in the umbilical cord before respiration is established. A child, especially if feeble and delicate, may die from exhaustion under these circumstances. This cause of death may be suspected, when a sero-sanguinolent tumour is found on the head of a child, and the head itself is deformed or elongated:—internally by the congested state of the cerebral vessels. The existence of deformity in the pelvis of the woman might corroborate this view; but in primiparous females (among whom charges of child-murder chiefly lie,) with well formed pelves, delivery is frequently protracted. It is presumed that there are no marks of violence on the body of the child, excepting those which may have arisen accidentally in attempts at self-delivery.

2. *Debility.*—A child may be born prematurely or at the full period, and not survive its birth, owing to a natural feebleness of system. This is especially observed with immature children; and it is the condition more especially dwelt on by Dr. Hunter. Such children may continue in existence for several hours,

feebly respiring, and then die from mere weakness. These cases may be recognised by the appearance of a general want of development in the body.

3. *Hemorrhage. Laceration of the cord.*—A child may die from hemorrhage, owing to a premature separation of the placenta or an accidental rupture of the umbilical cord. In the latter case it is said the loss of blood is not likely to prove fatal, if respiration has been established; but an instance is reported where a child died from hemorrhage even under these circumstances. (Henke's Zeitschrift, 1839, Erg. H. 200; also 1840, i. 347, and ii. 105. Ann. d'Hyg. 1831, ii. 128.) Hemorrhage from the cord has in some cases taken place at various periods after birth, and has led to the death of the child. (Ed. Month. Jour. July, 1847, 70.) Death from hemorrhage may be commonly recognised by the blanched appearance of the body, and a want of blood in the internal organs, but there are several cases on record where the cord has been ruptured close to the abdomen, without causing the death of the child. It was formerly a debated question whether in the event of the umbilical cord being left untied after cutting or laceration, such a degree of hemorrhage could in any instance occur as would prove fatal to a child. The case just now referred to renders it unnecessary to discuss this question. Hemorrhage is more likely to prove fatal, when the cord is divided by a sharp instrument, than when it is lacerated; and its dangerous effects on the child are likely to be great in proportion as the division is made near to the umbilicus. It has been improperly described as a case of infanticide by *omission*, where a self-delivered woman neglects to apply a ligature to the cord under these circumstances; because it is said she ought to know the necessity for this in order to prevent the child dying from hemorrhage. Such a view assumes not only malice against the accused, but that in the midst of her distress and pain she must necessarily possess the knowledge and bodily capacity of an accoucheur, a doctrine wholly repugnant to the common feelings of humanity. This question was, however, actually raised in the case of The *Queen* v. *Dash*, Aug. 1842. There was no doubt in this instance that the child had breathed, and that its death had been caused by hemorrhage from the lacerated umbilical cord. The medical witness properly admitted, that the cord might have been torn through by the mere weight of the child during labour; and the jury acquitted the prisoner on the ground that she might have been ignorant of the necessity or not have had the power to tie the cord. The cord, especially when short, may become accidentally ruptured during delivery. A case of this kind is reported by Mr. Mackie. (Med. Times, July 24, 1847, p. 433.) The child was born alive, after a very strong pain, and on examination it was found that the cord was torn through at about an inch from the abdomen.

4. *Compression of the cord.*—When a child is born by the feet or buttocks, the cord may be so compressed under strong uterine contraction, that the circulation between the mother and child will be arrested, and the latter will die. The same fatal compression may follow, when during delivery the cord becomes twisted round the neck. A child has been known to die under these circumstances before parturition, the cord having become twisted round its neck in utero. (Med. Gaz. Oct. 1840, 122.) Other cases from this cause, during delivery, will be found in the same journal. (Vol. xix. 232, 933.) On these occasions, the child is sometimes described to have died from strangulation; but it is evident that before the establishment of respiration, such a form of expression is improper. There are few or no appearances indicative of the cause of death. There may be lividity about the head and face, and cerebral congestion internally: it is, however, proper to state, that the brain of a child is always more congested than that of an adult.

5. *Malformation.*—There may be a deficiency of some vital organ, which would at once account for the child dying either during delivery or soon after its birth. Two cases are reported, in one of which the child died from an absolute deficiency of the œsophagus,—the pharynx terminating in a cul-de-sac: in the other, the

duodenum was obliterated for more than an inch, and had occasioned the child's death. (Med. Gaz. xxvi. 542.) In a third, recorded by Mr. Fairbairn, a child was suffocated by the retraction of the base of the tongue owing to defect of the frænum. (North. Jour. Med. March, 1846, p. 278.) The varieties of malformation are very numerous, but there can be no difficulty in determining whether it be such as to account for death. Individuals are not allowed to destroy these monstrous births; and the presence of all marks of violence in such cases should be regarded with suspicion. It is the more necessary to make this statement, as there is an idea among the vulgar, that it is not illegal to destroy a monstrous birth. Mr. Pooley, of Cirencester, informs me that the following case occurred some years since in his practice:—A lady was delivered of a most hideous dicephalous monster. In his absence, and at the earnest solicitations of the friends, the nurse destroyed it. The question was—Was this woman guilty of child-murder? The only case in reference to this point which is recorded by medico-legal writers, is that of two women who were tried at the York Assizes in 1812, for drowning a child which was born with some malformation of the cranium, in consequence of which it was likely that it could not survive many hours. There did not appear to have been any concealment on the part of the prisoners, who were not aware of the illegality of the act. (Paris and Fonblanque, Med. Jur. i. 228.) The absence of malicious intention would probably lead to an acquittal on the charge of murder; but such an act would doubtless amount to manslaughter. The degree of monstrosity or the viability of the offspring cannot be received as extenuating circumstances: as to the first, if a liberty of judging what was monstrous and what not, were conceded to any ignorant nurse, children simply deformed might be put to death on this pretence:—as to the second, it is held in law that whoever accelerates death causes it,—hence the fact that the offspring is not likely to live more than a few hours, does not justify the act of one who prematurely destroys it.

6. *Congenital disease.*—It has been elsewhere stated, that a child may be born labouring under such a degree of congenital disease as to render it incapable of living. The discovery of any of the fœtal organs merely in a morbid condition, amounts to nothing, unless the disease has advanced to a degree which would be sufficient to account for death. There are, doubtless, many obscure affections, particularly of the brain, which are liable to destroy the life of a child without leaving any well marked post-mortem changes. According to Dr. Burgess, apoplexy and asphyxia are very common causes of death among new-born children. (Med. Gaz. xxvi. 492; Henke's Zeitschrift der S. A. 1843, p. 67.) Probably diseases of the lungs are of the greatest importance in a medico-legal view; because, by directly affecting the organs of respiration they render it impossible for a child to live or to survive its birth for a long period. These diseases in the fœtal state are principally congestion, hepatization, tubercles, scirrhus, and œdema,—the existence of any of which, it is not difficult to discover. They render the structure of the lungs heavier than water, and thus prevent the organs from acquiring that buoyancy which in their healthy state they are known to have. It is not common to find the lungs diseased throughout:—a portion may be sufficiently healthy to allow of a partial performance of respiration. The lungs may not be found diseased, but simply in that state which has been elsewhere described under the name of atelectasis. The causes upon which this condition of the lungs depends are not well understood. The non-establishment of respiration sometimes arises from the mouth and fauces of the child being filled with mucus. An enlargement of the thyroid gland has occasionally led to the death of a new-born child by suffocation. (Ed. Month. Jour. July, 1847, 64.)

Conclusions.—The following conclusions may be drawn from the preceding remarks:—

1. That a large number of illegitimate children, especially when immature, are born dead from *natural* causes.

2. That a child may die from exhaustion, as the result of a protracted labour.

3. That if the child be prematurely born, or if it be small and weak, even at the natural period, it may die from mere debility, or want of power in the constitution to commence or continue the act of respiration.

4. A child may die from hemorrhage, owing to accidental rupture of the cord during delivery. It may even die from this cause after it has breathed.

5. That fatal hemorrhage is more likely to occur when the cord has been cut close to the abdomen, than when it has been lacerated, or cut at a distance from the navel.

6. That the division of the cord, whether by rupture or incision, without ligature, is by no means necessarily fatal to a healthy mature child.

7. That a child may die from accidental compression of the cord during delivery,—the circulation between the mother and child being thereby arrested before respiration has commenced.

8. That death may speedily follow birth, from some malformation or defect of important organs.

9. That the child may die from congenital disease, affecting the organs of respiration or the air-passages.

CHAPTER XLV.

VIOLENT CAUSES OF DEATH.—FORMS OF VIOLENT DEATH UNATTENDED BY MARKS OF EXTERNAL VIOLENCE—SUFFOCATION—DROWNING—IN THE SOIL OF PRIVIES—POWER OF LOCOMOTION AND EXERTION IN FEMALES AFTER DELIVERY.—DEATH OF THE CHILD FROM COLD AND EXPOSURE—STARVATION—IMMATURITY IN CASES OF ABORTION.—WOUNDS, EVIDENCE FROM, IN NEW-BORN CHILDREN—FRACTURES OF THE SKULL SPONTANEOUS AND CRIMINAL.—DEATH OF THE CHILD FROM DELIVERY IN THE ERECT POSTURE—ACCIDENTAL INJURIES IN UTERO—DEFICIENT OSSIFICATION—TWISTING OF THE NECK.—VIOLENCE IN SELF-DELIVERY.—GENERAL CONCLUSIONS.

Violent causes of death.—In this chapter we shall have to consider all those modes of death which are totally independent of the existence of congenital disease or other natural causes. It is proper for the medical jurist to remember that there are certain forms of child-murder which are not necessarily attended with any appearance indicative of violence,—these are, suffocation, drowning, exposure to cold, and starvation.

1. *Suffocation.*—This is a very common cause of death in new-born children. A wet cloth may be placed over the child's mouth, or thrust into that cavity during birth or afterwards, and before or after the performance of respiration. To the latter case only, could the term suffocation be strictly applied. A child may be thus destroyed by being allowed to remain closely compressed under the bed-clothes after delivery, or by its head being thrust into straw, feathers, and such like substances. The post-mortem appearances are seldom sufficient to excite a suspicion of the cause of death unless undue violence has been employed. There is commonly merely lividity about the head and face, and slight congestion in the lungs. A careful examination of the mouth and fauces should be made, as foreign substances are sometimes found in this situation, affording circumstantial evidence of the mode in which suffocation has taken place. Thus wood, straw, feathers, dust, or a hard plug of linen, may be, and in some cases have been found blocking up the mouth and fauces. Again, a child may be suffocated by having its head held over mephitic vapour, as the exhalations of a privy or of burning sulphur; and it may be here necessary to remind the medical jurist that other highly poisonous vapours may be used by a criminal without leaving

any trace upon the body, except, possibly, that which may depend upon their peculiar odour. There are few of these cases of suffocation in which a medical opinion of the cause of death could be given, unless some circumstantial evidence were produced, and the witness were allowed to say whether the alleged facts were sufficient to account for death. (Annales d'Hyg. 1832, i. 621.)

On the other hand, if it be even clearly proved that death has been caused by suffocation, it must be remembered that a child may be accidentally suffocated, and the crime of murder falsely imputed. Dr. Hunter, who was well aware of the risk to which a female might be thus exposed, observes, in relation to this point, —"When a woman is delivered by herself, a strong child may be born perfectly alive, and die in a very few minutes for want of breath, either by being on its face in a pool formed by the natural discharges or upon wet clothes;—or by the wet things over it collapsing and excluding air, or drawn close to its mouth and nose by the suction of breathing. An unhappy woman delivered by herself, distracted in her mind and exhausted in her body, will not have strength or recollection enough to fly instantly to the relief of her child." (Op. cit. 35.) It may be added that a primiparous female may faint or become wholly unconscious of her situation; or if conscious, she may be ignorant of the necessity of removing the child, and thus it may be suffocated without her having been intentionally accessory to its death. In such cases, however, there should be no marks of violence on the body, or they should be of such a nature and in such a situation as to be readily explicable on the supposition of an accidental origin. An infant is very easily destroyed by suffocation. If the mouth and nostrils be kept covered for a very few minutes, by being closely wrapped in clothes, asphyxia may come on without this being indicated by convulsions or any other marked symptoms. A suspicion of murder may arise in such cases; but the absence of marks of violence, with an explanation of the circumstances, will rarely allow the case to be carried beyond an inquest. Sometimes the body is found maltreated, with marks of strangulation about it,—concealed in a feather-bed or privy;—or cut up and burnt. This kind of violence may probably excite a suspicion of murder, and lead to the belief that the allegation of death from accidental suffocation is a mere pretence. This, however, is purely a question for the jury, and not for a medical witness. Unless the case be of a very glaring nature, the violence is considered to have been employed for the purpose rather of concealing the birth of the child than destroying it. In the present day, these cases of death from accidental suffocation, when properly investigated, can never implicate an innocent woman in a charge of murder, although the facts may show in many instances that the death of the child was really due to great imprudence, neglect or indifference.

The following case, (The *Queen* v. *Mortiboys*,) tried in 1841, will show that even when the evidence is very strong against a person, the circumstances will be favourably interpreted. In this instance, it was proved that the body of the child was discovered in a box containing wool; it was lying on its abdomen, with its face raised and its mouth open. A red worsted comforter had been passed twice round the neck, and was tied a second time in a single knot over the chin. In the mouth, which was open, was found a small quantity of fine flocks of wool. The medical evidence showed that the child had been born alive, the left lung being fully inflated. The brain was congested. There was no mark produced by the ligature on the neck, either externally or internally. Death was referred to obstructed respiration (suffocation,) caused partly by the ligature and partly by the wool in the mouth,—but the latter was considered to be the more active cause. In the defence it was urged that the ligature could not have produced strangulation, because the comforter was tied upon the chin,—that the medical evidence showed the wool in the mouth to have been the immediate cause of death,—this was probably taken into the mouth by the child itself in the instinctive action of breathing, and not put there by the prisoner for the purpose

of suffocation. The child had probably been placed carelessly on a quantity of wool, into which it had sunk by its own weight, and this had caused its death. It is reported that the judge joined in this view, and in charging the jury said that had the prisoner intended to choke the child with the wool, she would have inserted enough to fill its mouth. The prisoner was acquitted. In this case, admitting that the evidence did not bear out the charge of murder, still it is quite clear that death was caused by the child being placed on its face, with a ligature round the neck, in a closed box filled with wool. Admitting the facts to have been as represented, there appears to have been something more than an accident for the prisoner must have known that a new-born infant was not likely to live under such circumstances, and had the child been a week or a month old, she would probably have been convicted of manslaughter or murder. A very interesting case of alleged infanticide, by suffocation, has been reported by Dr. Easton. (Cormack's Journal, Feb. 1845.) There is no doubt that the child in this case was suffocated by a quantity of mud being forced into its mouth and fauces. Its presence in the œsophagus was incompatible with its having entered by gravitation. In the case of *Mackintyre* (Glasgow Aut. Circ. 1829,) several small pieces of straw were found in the stomach of the child, of the same kind as those which were in the bed where the birth took place.

2. *Drowning.*—The fact of drowning cannot be verified by any appearances on the body of a child which has *not* breathed. Thus, if a woman caused herself to be delivered in a bath, and the child were forcibly retained under water (a case which is said to have occurred,) it would of course die; but no evidence of the mode of death would be found in the body. [For a case in which a child was thus destroyed, probably, however, through accidental circumstances, see Cormack's Ed. Journal, Oct., 1845, p. 796.] After respiration, the signs of drowning will be the same as those met with in the adult. (See post, DROWNING.) The main question for a witness to decide, will be whether the child was put into the water living or dead. Infanticide by drowning is by no means common:—the child is generally suffocated, strangled, or destroyed in other ways, and its body is then thrown into water, in order to conceal the real manner of its death. The fact of the dead body of an infant being found in water, must not allow the witness to be thrown off his guard, although a verdict of "found drowned" is so commonly returned in these cases. The body should be carefully inspected, in order to determine what was really the cause of death. All marks of violence on the bodies of children that have died by drowning, should be such as to have resulted from accidental causes. It is not necessary that the *whole* of the body should be submerged, in order that a child should be destroyed by drowning: the mere immersion of the head in water will suffice to produce all the usual effects. A case occurred in London, in 1842, where a woman attempted to destroy her child by immersing its head only in a bucket of water. The child was discovered, and resuscitated.

New-born children may be drowned or suffocated by being thrown into a well or into the soil of a privy. Sometimes the child is destroyed in other ways, and its body is thus disposed of for the purposes of concealment. Should there be a large quantity of liquid present, the phenomena are those of drowning. The liquid abounding in hydrosulphuret of ammonia may then be found, if the child were thrown in living, in the air-passages and the stomach. On these occasions the defence may be,—1, that the child was born dead, and that the body was thrown in for concealment; but the medical evidence may show that the child had breathed and had probably been born living. 2. It may be alleged that the child breathed for a few moments after birth, but then died, and that the female thus attempted to conceal the body. A medical witness may be here asked, whether a woman could have had power to convey the body to the place —a point which must, as a general rule, be conceded. 3. It is most commonly urged, that the woman being compelled to go to the privy, was there delivered

unconsciously, and that the child dropped from her, and was either suffocated or prevented from breathing. All these circumstances may readily occur, but on the other hand the explanation may be inconsistent with medical facts. Thus the head or the limbs of the child may be found to have been separated or divided by some cutting instrument,—or a cord or other ligature may be found tightly bound around its neck, or there may be a tightly fitting plug in the fauces. Then, again, the body may be entire, but the umbilical cord may be *cleanly cut*. This would tend to set aside the explanation of the child having accidentally dropped from the female; because in such an accident the cord should be found *ruptured*. The practitioner should make a careful examination of the divided ends of the cord by the aid of a lens, or a rupture may be mistaken for a section with a sharp instrument. Mr. Higginson, of Liverpool, has lately published a case of some interest in this point of view. The child fell from the mother, and the cord broke spontaneously. "The torn ends were nearly as sharp-edged and flat as if cut." (Med. Gaz. vol. xlviii. p. 985.) This case goes to prove that a careless or hasty examination of the ends of the cord may lead to a very serious mistake. Sometimes the mark of a previous cut may be found on the cord near one of its divided ends,—the first cut with scissors not having effectually divided it. In a case tried at Lewes Lent Assizes, 1852, Mr. Gardner proved, in reference to the body of a child which had been found in a privy, that the cord had been ineffectually cut in one spot previous to its complete division. The cord had also been pulled out after this cut, so as to elongate the vessels; hence they projected from one part of the sheath at one cut portion, while they were retracted in the other. This accurate observation showed not only that the cord had not been ruptured by the child accidentally falling from the mother, but it served to establish the identity of the placenta, which was found concealed at a distance from the body. In an interesting case which occurred to Dr. Wharrie, where the child fell from a female while sitting over a large jug containing water, and in which it was evident there had been no respiration, the cord was found secured. The child was removed from the vessel, dead; therefore, the ligature must have been applied after death. When the cord is found lacerated, this will be cæteris paribus in favour of the woman's statement as to the mode in which her delivery occurred. (For a case involving this question, see Med. Gaz. x. 374.)

Circumstantial evidence.—Whether, in any instance, the *drowning* of a child was accidental or criminal, must be a question for a jury to determine from all the facts laid before them. The situation in which the body of an infant is found, may plainly contradict the supposition of accident. On the other hand, a child may be accidentally drowned by its mouth falling into a pool of the discharges during delivery, although this would be rather a case of suffocation. The stomach of the child should always be examined on these occasions, as mud, sticks, straws, weeds, or other substances, may be found, indicating, according to circumstances, that the child had been put into the water living, and that it had been drowned in a particular pond or vessel.

Accidental delivery. The pains of labour mistaken for other sensations.—In cases like that reported by Dr. Wharrie, where a female, under the impression that she was about to have a motion, sat over a large water-jug and was delivered of a child, it is proper to make full allowance for a mistake which may be compatible with innocence. A woman is often unable to distinguish the sense of fulness, produced by the descent of the child, from the feeling which leads her to suppose that she is about to have an evacuation; and thus it is dangerous, when a labour has advanced, to allow a female to yield to this feeling; for there is nothing more probable than that the child will be suddenly born. Mr. Rankin, of Carluke, has reported two cases of this description, where there could not be the slightest suspicion of criminality. In one, a primipara, the child was actually born under these circumstances; but its life was fortunately saved.—had

there been no other convenience than a privy, it must have been inevitably lost. In the second, although a case of third pregnancy, the female was equally deceived by her sensations. (Ed. Month. Jour. Jan. 1846, p. 11.) It is true that this alleged mistaken sensation forms a very frequent and specious defence on charges of child-murder; but still a medical jurist is bound to admit that an accident which occurs to females of the middle class, may also occur to the poor without necessarily implying guilt.

Power of exertion in recently delivered females.—On these occasions, a witness will often find himself questioned respecting the strength or capability for exertion, evinced by the lower class of women, shortly after child-birth. Alison remarks, that many respectable medical practitioners, judging only from what they have observed among the higher ranks, are liable to be led into an erroneous opinion, which may be injurious to an accused party. He mentions a case, where a woman charged with child-murder walked a distance of twenty-eight miles in a single day, with her child on her back, two or three days after her delivery. (Case of *Anderson*, Aberdeen Spring Cir. 1829.) Instances have even occurred in which women have walked six and eight miles on the very day of their delivery, without sensible inconvenience. (Criminal Law, 161.) In one case (*Smith*, Ayr Spr. Circ. 1824,) the woman was engaged in reaping,—retired to a little distance, effected her delivery by herself, and went on with her work for the remainder of the day, appearing only a little paler and thinner! In the case of *Macdougal* (Aberdeen Spring Circ. 1823,) the prisoner, who was sleeping in bed with two servants, rose, was delivered, and returned to bed without any of them being conscious of what had occurred. Cases like the last have often presented themselves in the English Courts.

3. *Cold.*—A new-born child may be easily destroyed by simply exposing it uncovered, or but slightly covered, in a cold atmosphere. In a case of this kind, there may be no marks of violence on the body, or these may be slight and evidently of accidental origin. In death from cold, the only appearance occasionally met with has been congestion of theb rain with or without serous effusion in the ventricles. (See COLD.) The evidence, in these cases, must be purely circumstantial. The medical witness may have to consider, how far the situation in which the body was found,—the kind of exposure and the temperature of the air, would suffice to account for death from the alleged cause. There is no doubt that a new-born child is easily affected by a low temperature, and that warm clothing is required for the preservation of its life. An inspection of the body should never be omitted on these occasions, because it may turn out that there was some latent cause of natural death which would at once do away with the charge of murder. Admitting that the child died from cold, it becomes necessary to inquire whether the prisoner exposed it with the malicious intention that it should thus perish. Unless wilful malice be made out, the accused cannot be convicted of infanticide. In general, females do not expose their children for the purpose of destroying them, but for the purpose of abandoning them: hence it is rare to hear of convictions for child-murder, where cold was the cause of death, although some medical jurists have called this infanticide by *omission*, an offence which does not appear to be recognised by the English Law. In the case of The *Queen* v. *Walters* (Oxford Autumn Assizes, 1841,) it was proved that the prisoner, while travelling in a wagon, had suddenly left it, and that she was delivered of a child, which was afterwards found dead and exposed on the road. There was no doubt that the child had been born alive; for it was heard to cry after it was abandoned by its mother, who appeared to have carried it some distance after it was born. The child had died from exposure to cold. The woman was convicted of manslaughter, and sentenced to ten years' transportation. (For other medico-legal cases of death from cold, see Henke's Zeitschrift, 1836; also, 1840, i. 168, Erg. H.) In the case of *Reg.* v. *Waters* (Exchequer Chamber, Jan. 1849) the judges held on appeal that the count which charged the prisoner

with causing the death of her child by throwing it on a dust-heap, and leaving it exposed, was good, and the conviction was affirmed.

4. *Starvation.*—A new-born child kept long without food will die, and no evidence of the fact may be derivable from an examination of the body. There may be no marks of violence externally, nor any pathological changes internally to account for death. This is a rare form of committing murder, unless as it may be accidentally combined with exposure to cold. In order to convict the mother, it is necessary to show that the child was wilfully kept without food, with the criminal design of destroying it. Mere neglect or imprudence will not make the case infanticide. The only appearance likely to be found on examination of the body, would be complete emptiness of the alimentary canal. Without corroborative circumstantial evidence, this would not suffice to establish the cause of death: a medical witness could only form a probable conjecture on the point. In a suspected case of this kind, the contents of the stomach should be tested for farinaceous and other kinds of food.

5. *Immaturity in cases of abortion.*—From a recent case (*Reg.* v. *West*, Nottingham Lent Assizes, 1848,) it would appear, that if, by the perpetration of abortion, or the criminal inducement of premature labour, a child be born at so early a period of uterine life that it dies merely from *immaturity*, the party causing the abortion, or leading to the premature birth, may be tried on a charge of murder. A midwife was alleged to have perpetrated abortion on a female who was between the fifth and sixth months of pregnancy. The child was born living, but died five hours after its birth. There was no violence offered to it; and its death appeared to be due entirely to its immaturity. The prisoner was acquitted, apparently on the ground that abortion might have arisen from other causes.

Among those cases of violent death which leave on the body of the child certain marks or appearances indicative of the cause, may be mentioned wounds, strangulation, and poisoning.

6. *Wounds.*—Probably this is one of the most frequent causes of death in cases of infanticide. Wounds may, however, be found on the body of a child which has died from some other cause. The principal questions which a medical witness has to answer are:—1, Whether the wounds were inflicted during or after birth, or, to adopt the legal view of the matter, before or after the body of the child was *entirely* in the world in a living state; for, according to the decisions of our judges, a child is not considered living in law, at least its destruction does not appear to be *murder*, until its body is entirely born. In most cases it will be utterly impossible for a medical witness to return any answer to a question put in this form. All that medical evidence can pretend to show, is whether the child was living or not when the wounds were produced;—for whether the *whole* of its body was or was not in the world at this time, they will possess precisely the same characters. In a few cases only, a conjectural opinion may be formed from the nature, extent, and situation of these injuries.—2, The witness will be required to state, whether the wounds were inflicted before or after death.—3, Whether they were sufficient to account for death. 4, Whether they originated in accident or criminal design. The child may have been destroyed by *burning*, and evidence must then be sought for by an examination of the state of the skin. All these questions have been fully considered in treating the subject of WOUNDS; and they therefore do not require any further notice in this place.

A case of infanticide was tried at the Buckingham Summer Assizes, 1840, (The *Queen* v. *Wood*,) in which the main question was, whether five severe wounds found on the head of a child were inflicted before or after death, and accidentally or criminally. The mother confessed that the child was born alive, and had cried, but that it had died in five minutes after its birth. Its body was buried, and it was assumed that the wounds might have been accidentally inflicted

after death by a spade, which had been used for that purpose. The medical witness attributed death to the wounds, which, in his opinion, could not have been accidentally produced, but very properly admitted, in cross-examination, that the wounds would have presented the same appearances had they been inflicted immediately after death, while the blood was in a fluid state. Answers to questions of this kind can of course be given only in those cases where the body is examined soon after the infliction of the wounds. It would be extremely hazardous to pronounce an opinion when the child has been long dead. In the case of The *Queen* v. *Taylor* (York Lent Assizes, 1843,) the child had been dead about a year, and when its body was found in a garret, it was so much dried up, that the medical witnesses were unable, with certainty, to state the sex. The left arm had been removed from the body, and on the throat was a cut extending from ear to ear, which was considered to have been made by some sharp instrument, and which, from the retraction of the edges of the wound, the witnesses thought must have been produced during life, or immediately after death. The prisoner was acquitted. In this case there do not appear to have been any good medical reasons for the opinion expressed respecting the time at which the wound had been caused. Certainly, the retraction of the edges could furnish no evidence in a wound produced a year before, and in a subject so dried up as to render the recognition of the sex difficult. This may have been a case of child-murder, but there was no medical proof of it: it was not even proved that the child had come into the world living. Incised wounds found on the bodies of children may be referred to the use of a knife or scissors by the prisoner, in attempting to sever the navel-string, and therefore be due to accident. This point should not be forgotten, for a wound even of a severe kind might be thus accidentally inflicted. In such cases we should always expect to find the navel-string *cut*, and not lacerated. The end of it may, for the purpose of examination, be stretched out on a piece of white card. In the case of The *Queen* v. *Wales*, (Central Criminal Court, Sep. 1839,) it was proved that there was a wound on the right side of the neck of the child, not involving any important vessels, although it had caused death. The medical witness allowed that it might have been accidentally inflicted in the way suggested, and the prisoner was acquitted. As this question may be unexpectedly put at a trial, a witness should prepare himself for it by a careful examination of the wound and of the umbilical cord. This will in general suffice to show whether an incised wound has been produced accidentally in the manner alleged, or by criminal design.

Slight marks of external violence should not be overlooked:—minute punctures or incisions externally may correspond to deep-seated injury of vital organs. The spinal marrow is said to have been wounded by needles or stilettos introduced between the vertebræ, the skin having been drawn down before the wound was inflicted, in order to give it a valvular character, and to render it apparently superficial. The brain is also said to have been wounded by similar weapons, through the cribriform plate of the ethmoid bone or the fontanelles.

Fractures of the skull.—The only injuries which require to be specially considered in relation to infanticide, are fractures of the skull; and here the question to which we may restrict our examination is, whether the fracture arose from accident or criminal violence. Although it has been a matter of frequent observation, that great violence may be done to the head of a child during parturition, without necessarily giving rise to fracture, yet it is placed beyond all doubt that this injury may occur by the expulsive efforts of the uterus forcing the head of a child against the bones of the pelvis. Even the violent compression which the head sometimes experiences in passing the os uteri, may suffice for the production of fracture. (See Ed. M. and S. J., xxvi. 75.) Until within the last few years, it had been generally supposed that fractures of the cranium in newborn children were always indicative of criminal violence; but the cases collected by Dr. Schwörer of Freiburg, and others, have established the certainty of their

accidental occurrence. These accidental fractures, it is to be observed, are generally slight: they commonly amount merely to fissures in the bones, beginning at the sutures, and extending downwards for about an inch or less into the body of the bone.

The following case occurred to Dr. Schwörer, while performing his duties at the Obstetric Institution:—The child was still-born: he received it into his hands at birth, so that the head could have sustained no outward violence. On inspection, the skin over the vertex was found swollen; and on removing it, there was a large extravasation of blood beneath, especially over the right parietal bone. The bone was fractured or fissured in two places. Blood in a half-coagulated state was found beneath the fissures, between the bone and the dura mater, as also between this and the tunica arachnoides. (Beit. zur Lehr. v. d. Kindermord. Freiburg, 1836.) Here, then, were all the signs indicative of external violence; and possibly, had this woman been delivered in secret, and the body of the child found in a concealed place, she might have been charged with the murder. A second case is reported in Casper's Wochenschrift (Oct. 1840,) where about half a drachm of blood was extravasated on the right parietal bone, which was compressed in the centre, and presented a radiated fracture. Coagula were found on the dura mater. (See also B. and F. Med. Rev. xxi. 254, and vii. 333.) In a third case, where there was deformity of the pelvis, the child was born dead, and there were two fissures, about an inch long, in the left parietal bone; and both parietal bones were considerably flattened. (Casper's Wochenschrift, Sept. 1837.) [See B. and F. Med. Rev. April, 1852, and Am. Jour. M. S., July, 1852, for three additional cases from Casper's Wochenschrift, 1851.—H.]

Dr. West has reported the following case of spontaneous fracture of the left parietal bone, during a natural but tedious labour, in which the head was five hours in the pelvic cavity, although the pelvis was well formed. There were three fissures in the bone; one running into the sagittal suture, one to the anterior inferior angle, and the other to the middle of the anterior edge of the bone. The child was still-born. Much blood was effused beneath the scalp, but none under the skull. (Med. Gaz. xxxix. 288.)

In respect to these accidental fractures and extravasations, it may be remarked that they are in general recognised by their very slight extent. [The frontal and parietal bones are the only ones which Dr. Weber (On the Strength of the Skull) has seen fissured and fractured by the act of parturition. (*Vide* Am. Jour. Med. Sci. Jan. 1853, 254.)—H.] In cases of murder by violence to the head, the injuries are commonly much more severe: the bones are driven in,—the brain protrudes, and the scalp is extensively lacerated. Such severe injuries as these cannot arise accidentally, from the action of the uterus during parturition. In these cases, however, it may be fairly urged, that the woman was unexpectedly seized with labour, that the child was expelled suddenly by the violent efforts of the uterus, and that the injuries might have arisen from its head coming in contact with some hard surface—as a floor or pavement. It must be admitted, that a woman may be thus suddenly and unexpectedly delivered while in the erect posture, although this is not common among primiparous females; and that injuries may be thus produced on the head of a child.

Delivery in the erect posture.—An interesting case of sudden delivery in the erect posture in a primiparous female, without injury to the child, is reported by Dr. W. Burke Ryan, in the Lancet, June 21, 1845, p. 707. The umbilical cord was in this instance ruptured at the distance of about two inches from the navel. In another case, also of a primiparous female, sudden delivery took place while the woman was in the act of sitting down. The child was forcibly expelled, and fell with its head on the floor of the room. It was taken up dead, the cord being still attached to it and the placenta, which came away shortly after the birth of the child. (Med. Gaz. xxxvii. 808.) It would appear from

cases collected by Dr. Klein, that fractures of the cranium under these circumstances are of very rare occurrence. Out of one hundred and eighty-three cases reported by him, in which the women were rapidly delivered while sitting, standing, or inclined on the knees,—the child falling on the ground or floor, there was only one instance in which the child was killed; and there was not a single case in which the bones of the cranium were fissured or fractured, so far as could be ascertained by external examination. (Devergie, i. 631; Briand, ii. Chaussier performed some experiments on the bodies of still-born children, allowing them to fall with their heads downwards on a paved floor, from a height of eighteen inches; and he found that out of fifteen cases one or other of the parietal bones was fractured in twelve. Although these results are conflicting, yet Klein's observations appear more to the purpose; because they were made under circumstances in which the question would really arise in a case of infanticide. They are strikingly supported by the following case, which occurred to Mr. Blacklock. (Lancet, July 26, 1845.) A married woman was suddenly delivered while standing:—the child fell to the floor, but sustained no injury. The umbilical cord was ruptured close to the umbilicus. (See, also, Dr. Ryan's case, supra.) A case analogous to these, also in a primipara, is reported in the Gazette Médicale, 26 Juin, 1847. A woman, æt. 27, was delivered of a child while in the act of walking to the hospital, at the distance of a mile. She stated that she had lost a large quantity of blood. The child, which she brought in her apron, was mature and living: the umbilical cord had been ruptured close to the abdomen. (See also another case by Dr. Pickford, Med. Gaz. vol. xli. p. 731.) These observations would lead to the inference that such accidents are not very likely to occur, yet we cannot deny the *possibility* of their occurrence: therefore a barrister is fully justified in endeavouring upon this ground to exculpate a person charged with child-murder. A medical witness would find no difficulty in determining the probability of this explanation of the origin of the fractures, if he were made acquainted with all the facts connected with the delivery. But the acquisition of this knowledge must be accidental; and it will in general be out of his power to obtain it. Sometimes the fractures will be accompanied by incisions, punctures, or lacerations of the scalp or face:—in this case, although the origin of the fractures might be accounted for by the alleged fall during parturition, the cause of the other injuries would still remain to be explained. (See the case of The *Queen* v. *Reeve*, Cent. Crim. Court, Feb. 1838. The *Queen* v. *Stevens*, Bodmin Lent Ass. 1845.) The medico-legal importance of this subject will be apparent from the evidence given in a case tried before the Criminal Court of New York, in November, 1834. (Med. Gaz. xviii. 684.) One of the medical witnesses positively denied that the bones of the cranium could be fractured by the action of the uterus during parturition! It appeared highly probable that the fracture had been here occasioned by the accidental fall of the child during delivery—and the prisoner was acquitted. Dr. Wharrie has published an interesting case, also the subject of a criminal charge, in which it is probable that a fracture of the cranium of a child was produced by the expulsive action of the uterus. The body of the child had been found secretly buried. It was fully developed, but had evidently not breathed. The navel-string had been cut and tied; six inches of it still remained attached to the body. On the left side of the cranium, near the vertex, there was a small extravasation of blood, and on removing this, a fissure half an inch in length was found in the edge of the left parietal bone, close to the line of the sagittal suture, and near the posterior fontanelle. On shaving off the hair, there was no discoloration, nor any mark on the skin indicative of a blow. There was no evidence to show that any violence had been used to the child at its birth, and from the description of the fissure it was a fair presumption that it had arisen during delivery from the muscular contractions of the uterus. (Cormack's Monthly Jour., Nov. 1846, p. 847.)

Length of the umbilical cord.—It has been recommended on these occasions, that we should observe the length of the umbilical cord, and notice whether it be cut or lacerated, as these facts may, it is presumed, throw some light on the question. But a medical witness can seldom procure the cord for examination, although it will generally be in his power to ascertain whether it was cut or lacerated, by examining the portion which is attached to the body of the child. The cord varies in length,—the average being from eighteen to twenty inches: but it has been met with so short as six inches (Lancet, June 13, 1846, p. 660,) and even five inches. (Lancet, July 11, 1846, 49.) In a twin case which occurred to Mr. Stedman, of Guildford, the cord was only *four inches* long. (Lancet, Aug. 28, 1841.) On the other hand, in one instance, where it was found twice twisted round the child's neck, it was fifty-three inches long. Dr. Churchill found, out of three hundred and ninety-one cases, that the shortest cord was twelve inches, and the longest fifty-four inches in length. In a case reported by Mr. Wood, it was sixty-one inches long, and coiled twice round the abdomen of the child (Med. Gaz. xlv. 263.) As the whole of the cord can rarely be obtained, it is unnecessary to discuss the question, whether it were long enough to admit of the falling of the child without rupture. It has been remarked, that when the cord is ruptured from accidental causes during delivery, the rupture takes place either very near its placental or umbilical end. In twenty-one of the cases observed by Klein, it was found to have been forcibly torn out of the abdomen; but it may be torn or lacerated at any part of its length, although the rupture is commonly observed to occur near one or the other extremity. It does not appear how the examination of the cord can throw any light upon the origin of these fractures of the cranium.

Injuries accidentally sustained in utero.—A practitioner must remember that if at an advanced stage of pregnancy, a female should accidentally fall, the child may sustain injury by a blow through the abdominal parietes. This is not to be strained into a specious defence for violence which has obviously occurred subsequently to birth, but the fact itself is of sufficient importance to merit attention, as the following case will show:—A pregnant woman, within five days of the ordinary term of gestation, fell while running, so that her abdomen struck sharply against an angular stone. There was an immediate loss of blood, and the motion of the child ceased. Four days after the accident parturition came on. Dr. Stanelli found the head of the child much enlarged, and in a putrid state. The female died in an hour. On examining the child, the skull was found almost crushed, the parietal having become separated from the temporal bones as if by external violence. The marks of injury were entirely limited to the head. (Gazette des Hôpitaux, Nov. 7, 1846, p. 523.)

In accidents of this kind it is most probable that the child would be born dead. There might also be marks of violence on the abdomen of the mother. Some observers have described cases in which the limbs of the fœtus in utero have become deeply indented or spontaneously amputated, by the twisting of the umbilical cord around them. (Dublin Hospital Gazette, Jan. 1846, 153.) It is not possible that these accidental injuries could ever be mistaken for violence inflicted on the body of the child after its birth.

Defective ossification simulating violence.—In reference to injuries of the bones of the head in a new-born child, it may be proper to mention the particulars of a case referred to me by Mr. Lord, of Hampstead, in 1847. The dead body of a new-born child, wrapped up in brown paper and a towel, was found in a pond. Mr. Lord examined it for the inquest. The head was very much decomposed, and the scalp was extensively lacerated and destroyed over the parietal bones, which readily separated. The brain was reduced to a sanious pulp. The umbilical cord, which had not been tied, was cut obliquely at about six inches from the umbilicus. The lungs, which were very crepitant, readily floated on water, and bore up the heart. The body was generally bloodless. The point of diffi-

culty which the case presented consisted in the presence of two apertures on a parietal bone. These apertures were small and rounded, and it was a doubtful whether they had not been wilfully produced by some perforating instrument applied to the cranium. It was remarked that one aperture was situated near the temporal ridge, and in this situation the scalp was entire and uninjured. The other was situated in that part of the bone which corresponded to the lacerated portion of scalp. It was ascertained that no violence had been used in the removal of the body from the water. The bone was macerated, and carefully examined by the aid of a lens. It was then perceived that the apertures were quite regular at the edges, which were remarkably thin, evidently passing into a membranous condition. The internal table was also deficient, so that from the interior the bone was bevelled off gradually from each aperture. This examination left no doubt that the holes in the bone were not due to any mechanical violence applied during life, but to deficient ossification. These spaces had been membranous, and the membrane destroyed by decomposition. The putrefaction of the scalp, and its separation, might have been accelerated by a bruised condition of these parts during a difficult labour.

Twisting of the neck.—Children are sometimes destroyed in the act of birth by the neck being forcibly twisted, whereby a displacement of the cervical vertebræ, with injury to the spinal marrow, may occur and destroy life. Such injuries are immediately discovered by an examination. It should be remembered, however, that the neck of a child is very short, and that it always possesses considerable mobility.

Violence in self-delivery.—When the marks of violence found on the head, neck, and body of a child, cannot be easily referred to an accidental fall, it is very common to ascribe them to the efforts made by the woman in her attempts at *self-delivery*, and without any intention on her part of destroying life. The rules to guide a medical opinion in such a case must depend upon the nature, situation and extent of the injuries; and each case must be therefore decided by the circumstances attending it. (The *Queen* v. *Horder*, Abingdon Summer Ass. 1840.) This should be contrasted with two other cases (The *Queen* v. *Fretwell*, Hereford Summer Ass. 1842; *Queen* v. *Turner*, Worcester Winter Ass. 1842.) In the first two cases, the children were admitted to have been living:—in the one violence was chiefly confined to the head, and the prisoner was acquitted,—in the other the marks of violence were upon the neck, and the prisoner was convicted. These cases show the uncertainty attendant on a plea of this kind.—(See also two other instances, B. and F. Med. Rev. viii. 521.) Sanguineous tumours simulating fractures are sometimes found on the heads of new-born children. These depend on natural causes, and must not be confounded with marks of violence. (Med. Gaz. xxxvi. 1082.) They may be known by the unruffled state of the skin. A medical witness, however, must be prepared to show that a woman, at the time of her delivery, may from pain and anxiety become deprived of all judgment, and may destroy her offspring without being conscious of what she is doing. It is therefore a sound principle of law that mere appearances of violence on a child's body are not *per se* sufficient, unless there be some evidence to show that the violence was knowingly and intentionally inflicted, or the appearances are of such a kind as of themselves to indicate intentional murder. (Alison.) The benefit of a doubt will always be given in favour of the accused. See PUERPERAL MANIA, post.

Conclusions.—The conclusions to be derived from the contents of this chapter are:—

1. That a new-born child may die from violent causes, arising from accident.
2. That some forms of violent death are not necessarily attended with external signs indicative of violence.
3. That a child may be accidentally suffocated during delivery.

4. That the marks of death from drowning are not apparent, except in children which have breathed.

5. That the state of the umbilical cord may often furnish important evidence.

6. That some females, recently delivered, may have strength to exert themselves and walk great distances.

7. That a new-born child may speedily die from exposure to cold and privation of food.

8. That slight fractures of the bones of the cranium may arise from the action of the uterus on the head of the child during delivery.

9. That females may be unexpectedly delivered while in the erect posture: the umbilical cord is, under these circumstances, sometimes ruptured, and the child may sustain injury by the fall.

10. That the violence found on the body of a child may be sometimes referred to attempts innocently made by the female to aid delivery.

CHAPTER XLVI.

DEATH OF THE CHILD FROM STRANGULATION—DECEPTIVE APPEARANCES ON THE BODY.—STRANGULATION BY THE UMBILICAL CORD—DIAGNOSIS.—ACCIDENTAL MARKS RESEMBLING THOSE OF STRANGULATION—CONSTRICTION BEFORE AND AFTER DEATH—BEFORE AND AFTER RESPIRATION—CONSTRICTION BEFORE AND AFTER ENTIRE BIRTH—BEFORE AND AFTER THE SEVERANCE OF THE UMBILICAL CORD.—CONSTRICTION WITHOUT ECCHYMOSIS—EXAMINATION OF THE MOTHER—SUMMARY OF MEDICAL EVIDENCE—DEATH OF THE CHILD AFTER BIRTH FROM WOUNDS DURING DELIVERY. GENERAL CONCLUSIONS.

AMONG the forms of violent death, which are almost always attended with appearances indicative of criminal design, are the following:—

7. *Strangulation.*—The destruction of a new-born child by strangulation is not an unfrequent form of child-murder; and here a medical jurist has to encounter the difficulty, that the strangulation may have been accidentally produced by the twisting of the umbilical cord round the neck during delivery. We must not hastily conclude, from the red and swollen appearance of the head and face of a child, when found dead, that it has been destroyed by strangulation. There is no doubt that errors were formerly made with respect to this appearance; for Dr. Hunter observes,—"When a child's head or face looks swollen, and is very red or black, the vulgar, because hanged people look so, are apt to conclude that it must have been strangled. But those who are in the practice of midwifery know that there is nothing more common, in natural births, and that the swelling and deep colour go gradually off if the child live but a few days. This appearance is particularly observable in those cases where the navel string happens to gird the child's neck, and where its head happens to be born some time before its body."—(Op. cit. 27.) Strangulation by the umbilical cord can of course refer to those cases only in which the cord becomes firmly twisted round the neck after the respiratory process is established, and this is rather a rare occurrence; because death more commonly takes place by compression of the cord under these circumstances, and by the consequent arrest of circulation before the act of breathing is performed. The appearance of ecchymosis on the scalp, as well as lividity of the face, is very common in new-born children when the labour has been tedious and difficult; and, therefore, unless there were some marks of injury about the neck, this would not justify any suspicion of death from strangulation. The only internal appearance met with in death from this cause is a congested state of the cerebral vessels.

Strangulation by the umbilical cord.—It has been supposed that the strangulation produced by the wilful application of any constricting force to the neck, would be known from the accidental strangulation caused by the cord, by the fact that in the former case there would be a livid or ecchymosed mark or depression on the neck. But it may be objected to this view, that such a mark, although, from the great violence used, a common, is not a constant accompaniment of homicidal strangulation. On the other hand, although it was formerly a disputed question, it is now certain that the umbilical cord may itself produce, in some instances, a livid or ecchymosed depression. Among various cases which might be quoted in support of this view, is the following, reported by Mr. Foster. In April, 1846, he was summoned to attend a lady in labour with her first child. Owing to the size of the head, the labour was of a lingering kind, and the child came into the world dead. The umbilical cord was found coiled three times round the neck, passing under the right armpit; and upon removing it, *three parallel discoloured depressions* were distinctly evident. These extended completely round the neck, and corresponded to the course taken by the umbilical cord. The child appeared as if it had been strangled. (Med. Gaz. xxxvii. 485.) Had this child been born secretly, this state of the neck might have created a strong suspicion of homicidal violence. Strangulation after birth could not, however, have been alleged, because there would have been no proof of respiration. When a blue mark is found on the neck of a child whose lungs retain their fœtal characters, it is fair to presume, cæteris paribus, that it has been occasioned accidentally by the twisting of the umbilical cord during delivery. Mr. Price has communicated to the same journal the account of a case in which the cord was so tightly twisted around the neck of a child, that he was compelled to divide it before delivery could be accomplished. There was in this case a deep groove formed on the neck, and it conveyed the impression to himself and a medical friend, that, in the absence of any knowledge of the facts, they would have been prepared to say that the child had been wilfully strangled by a rope. (Med. Gaz. xxxviii. 40.) In this instance the cord was very short. A diagnosis might have been formed, as in the preceding case, by examining the state of the lungs. Dr. Mutter met with a case in which the child was born dead, and the cord was tightly twisted round its neck,—when removed, the neck exhibited a livid circle of a finger's breadth, smooth, and shining; but on cutting into this mark, no subcutaneous ecchymosis was found. (North. Jour. Med. Jan., 1845, p. 190.)

From two of these cases, it will be perceived that by trusting to ecchymosis in the mark as an absolute means of distinction between constriction produced by criminal means, and that which results from the umbilical cord, a serious error may be committed. As in the following case (reported in the Annales d'Hyg. 1841, i. 127,) a female charged with the murder of her child by strangulation, may be unjustly condemned. The child had fully and perfectly respired:—the lungs weighed one thousand grains, and when divided, every portion floated on water, even after firm compression. There was a mark on the neck, which was superficially ecchymosed in a part of its course. From an investigation of the facts, this appeared to have been a case in which the mark was produced accidentally by the umbilical cord, during attempts at self-delivery on the part of the woman. She was, nevertheless, convicted, and condemned to a severe punishment. The case establishes three points: 1, that partial ecchymosis may be produced on the neck by the umbilical cord becoming twisted around it; 2, that this may strangle a child after it has breathed at the outlet,—the cord was twenty-four inches long; 3, that a child's lungs may in a *few seconds* become sufficiently distended with air to give satisfactory evidence of respiration with the pulmonary tests. In the same journal, p. 428, will be found the report of another case, suggesting many important reflections in regard to the medical jurisprudence of infanticide. In this instance the umbilical cord and membranes

were actually used by the female as a means of strangulation: the child had not breathed, but was thereby prevented from respiring. There was superficial ecchymosis on each side of the neck over the sterno-cleido-mastoidei muscles. The defence was, that the child was born with the cord around its neck, and that it was, from this circumstance, accidentally strangled; but the medical evidence tended to show that the cord had been violently stretched and used as a means of strangulation. The child had *not breathed*, and the witnesses considered it to have been born dead, owing to the violence used by the woman. The cause of death here was certainly not strangulation, but arrested circulation. In the mean time, the case proves that ecchymosis may be the result of the constriction produced by the cord. (For additional remarks on this subject, see Henke's Zeitschrift, 1837, iv. 352; also Ed. M. and S. J., Oct., 1838, p. 282.) A case occurred to Mr. M'Cann, in September, 1838, in which the umbilical cord, which was of its full length, had been used as the means of strangulation. It was twisted once round the neck, passed under the left arm over the shoulders, and round the neck again, forming a noose or knot, which, pressing upon the throat, must have caused strangulation, as the tongue was protruded, and there were other clear indications of the child having been strangled. The hydrostatic test applied to the lungs proved that respiration had been performed.

Diagnosis.—When the mark is deep, much ecchymosed, and there is extravasation of blood beneath, with ruffling or laceration of the skin, it is impossible to attribute this to the effect of the umbilical cord. The lividity produced by the cord in the cases hitherto observed, has been only slight and partial, and unaccompanied by laceration of the skin, or injury to deep-seated parts. (For a very instructive case by Dr. Scott, in reference to this point, see Ed. M. and S. J. xxvi. 62.) On the other hand, in homicidal strangulation, much more violence being used than is necessary for destroying life, we should commonly expect to find great ecchymosis and extensive injury to the surrounding soft parts. On some occasions, all difficulty is removed by the discovery of the rope, tape, or ligature round the neck; or, if this be not found, the proofs of some ligature having been used will be discovered in the indentations or irregularly ecchymosed spots left on the skin, the depressed portions of skin being generally white, and the raised edges livid.

Marks on the neck may be produced by the umbilical cord without necessarily destroying the child's life: two cases of this kind are reported by Prof. Busch: (Br. and For. Med. Rev. x. 579;) or the child may be destroyed without ecchymosis being a necessary consequence of the constriction produced by it. (See case by Dr. Hanff, Henke's Zeitschrift, 1836, Erg. H.) There is much less risk of strangulation from twisting of the cord than is commonly believed. Out of one hundred and ninety cases, Dr. Churchill found the cord round the neck in fifty-two children. The shortest cord so disposed was eighteen inches long, and it occurred twice in seventy-five cases.

Accidental marks resembling those of strangulation.—In the fore part of the neck of a child, a mark of depression is sometimes accidentally produced by forcibly bending the head forwards on the chest, especially when this has been done repeatedly and recently after death. It may occur also as an accident during labour. Such a mark must not be mistaken for the effect of homicidal violence. It has been a question whether, independently of the constriction produced by the cord, the cervix uteri might not cause, during its contractions, an ecchymosed mark on the neck. I am not aware that there is any case reported which bears out this view; and it seems highly improbable that any such result should follow. The mark on the neck is sometimes such as not to be explained by an accidental constriction produced by the umbilical cord. The ecchymosis may be in detached spots or patches,—situated in the fore part of the neck, and evidently not arising from the employment of any ligature. These marks may depend on the forcible application of the fingers to the fore part of the neck of the child,

and the indentations have been known to correspond,—a fact which has at once led to a suspicion of the mode of death. It may be alleged in defence, that such marks might have been accidentally caused in two ways: 1. By the forcible pressure produced by the child's hand during labour, an explanation which is highly improbable, if respiration has been performed:—although a child has been known to breathe in breech-presentations, while the head was still in the vagina. 2. They will be more commonly referred to the violent attempt made by a woman at self-delivery, during a paroxysm of pain. This explanation is admissible, so long as it is confined to injuries probably received during labour; but supposing the marks to have been certainly produced after birth, it will not of course apply. The following case (The *Queen* v. *Ancliffe*, Nottingham Lent Assizes, 1842) is in this respect worthy of attention; for it appears to me to show that a defence of this kind may be sometimes strained:—The evidence proved that the prisoner was delivered of a child, under much suffering, on a stone floor, and in the presence of another woman,—a witness. The child was born alive, and was heard to cry several times. The witness left it in charge of its mother, and on returning shortly afterwards, she found it dead, with black marks upon its throat. The female midwife, who separated the child from the mother, deposed that it gave a sort of half cry;—she thought it was dead when she first saw it, and the marks on the neck were not more than a woman might have caused in attempting to deliver herself. The medical evidence showed that there were many ecchymosed marks upon the throat of the child; and on the right side of the neck, blood was extravasated. The marks might have been produced by the fingers:—death had been caused by pressure on the windpipe. The judge left it to the jury to say, whether the marks of violence might not have been unconsciously inflicted by the prisoner during labour. The jury returned a verdict of acquittal. (See also a case by Bellot, Ann. d'Hyg. 1832, ii. 205.) Among marks simulating violence, which are sometimes found on the necks of new-born children, Mr. Harvey has pointed out one of a very singular kind. In February, 1846, he was present at a delivery at which the child was expelled rather suddenly; and after making two or three convulsive gasps, it died. Whilst endeavouring to restore animation, he observed a bright red mark extending completely across the upper and fore part of the neck, from one angle of the lower jaw to the other, exactly as though it had been produced by strangulation with a cord, except that the mark was not continued round to the back of the neck. It was of a vivid red colour, and not like a bruise or ecchymosis: it had very much the appearance of a recent excoriation. It was most clearly defined in front, where it was about a quarter of an inch in breadth, and it became diffused at the sides. The face was not swollen, and there was no fulness of the veins. (Med. Gaz. xxxvii. p. 379.) The diagnosis here would have been based upon the colour of the mark—the unabraded state of the epidermis, and the absence of congestion of the face and venous system. Nevertheless, the case is of great importance, and the facts should be borne in mind in the examination of the body of a new-born child alleged to have been strangled.

An interesting case, which was the subject of a coroner's inquest, has been published by Mr. Rose in the same journal (xxxvii. 530,) in which red marks on each side of the nose of a new-born child were mistaken for the effects of violence applied to the nostrils during an attempt at suffocation. Mr. Rose examined them closely, and considered that they were nævi, and had nothing to do with the death of the infant!

Constriction before and after death—before and after respiration.—A medical witness is sometimes asked to state, on these occasions, whether the ligature or the fingers had been applied to the neck of the child, before or after death,—or before or after it had breathed. It is proper to observe, that so far as the external marks of strangulation are concerned, there is no difference in the appearances, whether the constriction take place during life or immediately after death,

while the body is warm. Casper's experiments render it highly probable, that when the constricting force is applied to the neck of a dead child at any time within an hour after death, the marks cannot with certainty be distinguished by any appearance from those made on a living body. (Wochenschrift, Jan. 1837.) With regard to the second point, it may be stated, that whether the child has breathed or not, provided it be *living*, the marks of violence present precisely the same characters. The following case is related by Casper:—The body of a new-born child was found concealed in a cellar, and the mother was charged with having murdered it. She confessed that she heard the child cry at the birth, but that it soon died. In about an hour afterwards, she tied tightly round its neck a band made of a few straws, which she had hastily twisted together for that purpose, in order, as she alleged, "to prevent it from awaking." On the fifth day, the body was examined: the child was mature, well formed, and had evidently breathed. The examiners referred death to strangulation: the woman was convicted, and sentenced to be imprisoned for life. An appeal was made against this sentence, and Casper's opinion was called for on the propriety of the medical inference of strangulation during life, from the mark on the neck. The witnesses had stated "that each straw in the band had produced a well defined depression, which was whiter than the surrounding skin, while the little folds or elevations between the straws were red;—and on cutting into these reddened portions, slight ecchymosis was found beneath." Casper gave his opinion, that the slight ecchymosis observed might have resulted from the application of the straw-band soon after death,—while the body was warm; and the circumstantial evidence allowed that the ligature might have been applied at some time within an hour after death. Hence he declared that there was a want of proof that this child had died from strangulation. In consequence of this opinion the punishment was mitigated. It is impossible to deny the correctness of the inference drawn by Casper, since the mark was undoubtedly such that it might have been produced either before or recently after death. Which of these two suppositions was the more probable, and whether it was more likely that a ligature should be put round a child's neck an hour *after* death to prevent it from awaking (!), or *before* death for the alleged purpose of destroying it, it was of course for a jury, and not for a medical witness to decide. If there was nothing more in the prisoner's favour than her own statement as to the time when she applied the ligature, and her object in applying it, it is certain that a very humane interpretation was put upon the facts. If the Court entirely believed Casper's opinion, the woman should have been altogether acquitted, instead of having the punishment merely mitigated. It can be no crime, however absurd and unaccountable it may appear, for a person to place a ligature round the neck of a child after death, to give the appearance of strangulation. When such an extraordinary plea as this is raised, it is a fair matter of inquiry for a jury, to consider the motives of human conduct, and to judge of such a defence on the principles of common sense. If carried too far, no one who was not seen by others to perpetrate the act, could be convicted of homicidal strangulation. In the case of The *Queen* v. *Wren*, tried at the Winchester Lent Ass. 1840, the medical evidence went to show that the child had breathed, and was born alive. There was a piece of tape tied round its neck very tightly, and fastened behind, and there was a discoloration of the skin beneath. The tongue was livid and swollen, and blood was extravasated beneath the scalp. The medical witness admitted that the mark on the neck might have been produced after death; and as he could not positively say that the child had been destroyed by strangulation, the prisoner was acquitted. (See also The *Queen* v. *Hyland*, Cent. Crim. Court, Aug. 1844.)

Constriction before or after entire birth.—Judging from what has occurred on several recent trials, a medical witness must prepare himself for another and more difficult question. Let us suppose it to be admitted as proved, that the

ligature was applied to the neck of a child while it was living, and after it had breathed;—it still remains to be determined, whether it was applied before after the legal birth of the child, or, as some judges have laid down the rule before or after an independent circulation has been established in the child's body. In the case of *R.* v. *Enoch*, Judge Parke held "that there must be independent circulation in the child before it can be accounted alive." (Archbold, 367.) By an "independent circulation," we can only understand the condition in which respiration is established, and the blood no longer passes from the mother to the child. Thus, this state would be proved by a cessation of pulsation in the cord, and the crying or audible respiration of the child. It will be seen that this is tantamount to insisting upon absolute proof of respiration, as evidence of life, and, therefore, entirely conflicts with the opinions of many other judges, who have held that proof of respiration is not necessary on a charge of murder, because a child might be born alive and not breathe for some time after its birth. (*R.* v. *Brain*, Archbold, 367.) On the other hand, if the proof of an independent circulation be the test of a child being legally alive at the time of the violence, the entire birth of its body is certainly not necessary for this; because, as it is well known, respiration may be established, and consequently an independent circulation acquired, before the body of the child is entirely *born*. Here, again, this judgment is opposed to the opinions of many judges, who have repeatedly held that whether a child has breathed or not, entire live birth must be proved. One of the most common judicial objections to the hydrostatic test is, that a child may breathe, *i. e.* substantially acquire an independent circulation, but die *before its body is born*. In this state of uncertainty, it is difficult to say *what* medical evidence is required to prove. If an independent circulation alone is sufficient, it cannot be always necessary to prove entire live birth; but if proof of entire live birth be sufficient, then it cannot be always necessary to show that the child had acquired an independent circulation when the violence was offered to it! In a celebrated case of tenancy by courtesy (*Fish* v. *Palmer*, 1806, post, BIRTH,) the judges of that time held that the quivering or spasmodic motion of a lip after birth without respiration, independent circulation, or any other sign of vitality, was sufficient to show that the child was born alive—and that it had thereby acquired civil rights which it could transmit to others,—its heirs. Why is the proof of an independent circulation in a child to be demanded of medical witnesses in a case involving a question of its murder, when, in respect to its acquisition of civil rights, such a proof is not called for? If the question were fairly considered by all the judges, probably proof of an independent circulation in this sense would not be required; at any rate it could not be consistently demanded, in the face of other decisions, that proof of respiration was not absolutely necessary to constitute live birth in law even in cases of child-murder. The last case in which this question was raised was on the Oxford Spring Circuit, 1841, (The *Queen* v. *Wright*.) The child was found concealed in a garden; its throat was completely cut, and there was a stab under the left arm. Baron Gurney is reported to have stopped the case because there was no proof that the child had had "an independent existence" when the wounds were inflicted. It is worthy of remark, that one form of murder may be the actual prevention of the establishment of an independent circulation or existence in the child, as where the cord is designedly tied before the commencement of the respiratory process. It has been suggested that ignorance of this point, among midwives, may be a cause of numerous still-births. In the mean time one fact is obvious, that whether the means of strangulation, if that be the form of murder, be applied to the neck of a living child before the entire birth of its body or afterwards,—before the establishment of an independent circulation (*i. e.* the act of respiration) or afterwards,—the appearances will be the same; and from these it will be impossible to say, when the strangulation was accomplished.

Constriction before or after severance of the umbilical cord.—There is still another novel form which this question has taken. The witness may perhaps be asked, whether the strangulation occurred before or after the umbilical cord was severed. It would appear that the severance of the cord has been regarded in law as a test of an independent circulation being established in the child:—but this is obviously an error depending on the want of proper information respecting the phenomena which accompany birth. Respiration, and therefore an independent circulation, may exist *before* the cord is divided; and its severance, which is never likely to take place until after entire birth, cannot consequently be considered as a boundary between a child which is really born alive, and one which is born dead. A premature severance, as it was just now stated, might positively endanger the life of the child, instead of giving to it an independent existence. A healthy and vigorous child may continue to live and breathe independently of the mother, before the division of the cord, and the time at which the severance is made depends on mere accident. Hence the marks of strangulation on the neck of a living and breathing child must be the same, whether the cord be divided or not. The object of putting such a question is not apparent, unless it is intended to be implied that no child is legally born alive until the accoucheur or the woman herself chooses to sever the cord. It would therefore follow, on this doctrine, that to strangle a living child (entirely born) with the umbilical cord, provided this be not lacerated in the attempt, would not constitute infanticide! If this inference be incorrect, it is impossible to see what can have been the object of asking a medical witness such a question on these occasions. A case in which the cord was actually used as the means of destruction has been already given. (See ante, p. 342.)

The following cases will illustrate the difficulties which a witness may have to encounter when it is alleged that the child has been destroyed by strangulation. The first is that of *Rex* v. *Crutchley*, (Monmouth Lent Assizes, 1837.) In this case the body of the child was discovered by a medical man (one of the witnesses) under the bed of the prisoner, who had been secretly delivered. There was a riband tied in a knot so tightly round its neck as to have prevented respiration. The child had evidently been dead some hours, and the prisoner alleged that it was born dead. On inspection, the face was found swollen and the lips livid: the lungs contained air, and were of a florid colour; they were crepitant and floated on water, so as to leave no doubt that the child had breathed. The vessels of the brain were gorged; the other viscera perfectly healthy. He attributed death to strangulation;—he thought that the ligature had been placed round the neck before the umbilical cord, which had not been tied, was secured; but the reason for this opinion is not stated. He considered that the child had been born *wholly* alive; but admitted that the ligature would have produced the same appearance on the neck, had it been applied before the complete birth of the child. Another witness, however, stated that he thought the ligature might have been placed round the neck before the entire body of the child was born. The defence was, that the ligature had been used by the woman for the purpose of assisting herself in the labour; and that the medical evidence allowed, whether this was the motive or not, that it had been applied before the child was actually born. The judge desired the jury to consider, whether the prisoner wilfully killed the child,—if so, whether the killing occurred before or after the entire birth of its body,—and lastly, whether the killing took place while it was still attached to the body of its mother. Unless the child was destroyed after entire birth, the prisoner would be entitled to an acquittal:—if destroyed, while still attached to the body of its mother, the point would be reserved for the consideration of the judges. The prisoner was acquitted. There can be no doubt that, provided a child be born entirely in a living state, the destruction of it would be murder, whether the cord were severed or not.

In the case of The *Queen* v. *Byron*, (Chester Aut. Ass. 1838,) the dead body

of the child was found with a piece of rag tied round its neck, which in opinion of the medical witness had caused death by strangulation; but on examination by the judge, he admitted that the appearances might be explained by supposing that the prisoner had produced them in attempting to deliver herself. In the case of The *Queen* v. *Millgate*, (Central Criminal Court, Nov., 1842,) a child was discovered dead, and on examination the face was livid, the tongue protruded, and the hands were clenched. Around the neck was a ligature which had been passed round four times, and was tied tightly. The vessels of the head were turgid, the lungs partially inflated, and the general appearance of the body was healthy. The medical witness thought that the child had been born alive, and had died from the effects of the ligature on the neck. The judge told the jury they must be satisfied that the child was completely born at the time the ligature was put round the neck. The prisoner was acquitted. In another case, The *Queen* v. *Webster*, (Worcester Lent Ass., 1839,) the following facts were deposed to by the surgeon:—The child was full-grown, and was born alive: this was inferred from the lungs being completely inflated. A ligature was found round the neck—it had been passed round twice—was very tight, and fastened in a knot: it had caused two deep indentations. The vessels of the scalp and brain were turgid with blood, but there were no marks of external violence. Death was caused by strangulation. The judge left it to the jury to say, whether they were satisfied that the child was wholly born into the world alive; and if so, whether the prisoner had knowingly and wilfully destroyed it after it was born. The prisoner was acquitted.

Constriction without ecchymosis.—It may be an important question whether, in these instances, the absence of any mark of discoloration of the skin by the ligature should be taken as evidence of the means of constriction not having been applied during life. What we are entitled to say from observed facts is, that ecchymosis from the ligature is not a necessary consequence of constriction, either in a living or dead child; although we might expect that there would be few cases of child-murder in which, when strangulation was resorted to, there would not be some ecchymosed mark or discoloration, chiefly on the presumption that great force is suddenly applied. Besides, it is not improbable that a slighter force would cause ecchymosis on the skin of a new-born infant than would be required to produce such an effect on that of the adult. When there is no mark from the ligature, an attempt may be made to show that death could not have been caused by strangulation, as in the following case, (The *Queen* v. *Hagg*,) which was tried at the Carlisle Summer Assizes, in 1841:—The medical evidence was to this effect. The deceased child was discovered with a tape tied tightly round its neck. It was full-grown and healthy, and had been born alive, as respiration had been fully established. The lungs filled the chest, floated on water, and crepitated when pressed. From the livid appearance of the face and neck, the congested state of the brain, and extravasation of blood on the surface, combined with the ligature round the neck, the witnesses were of opinion that the child had died from strangulation. On cross-examination, they said that a child may breathe when partially born. The floating of the lungs in water is of itself an uncertain test, if the body is at all decomposed. With other tests it affords a proof of a child having been born alive. One witness said the ligature had produced no mark of discoloration on the neck, while others said it was perceptible. The inference is, that the mark could not have been very apparent, or there would have been no discrepancy on this point. It was very ingeniously urged in the defence, that the child could not have died from strangulation, because a tape tied so tightly round a child's neck as to cause death in this way, would necessarily leave a discoloration of which no person could have any doubt. The prisoners were convicted. Had the defence been, as in the former cases, that there was no proof whether the ligature had been applied before or after entire birth, or the establishment of an independent existence in the child, the result

might have been different. From the cross-examination it will be seen in what way the objections to the hydrostatic test are ingeniously made to affect medical evidence. An answer to a *general* question is rendered applicable to a *particular* case. A witness admits on a trial that the lungs may float from putrefaction or artificial inflation; in short, from other causes than respiration. If this answer be not qualified, an impression is immediately conveyed to the court, and not always removed by a re-examination, that some of those causes may have given rise to the floating of the lungs in this particular instance,—when in fact there may have been not the least trace of putrefaction, nor the least ground for suspecting that artificial inflation had been practised. As contrasts to this case, see report of a case which occurred to Mr. Coales (G. H. Rep., 1842;) and another by Dr. Scott (Ed. Med. and Surg. J., xxvi. 62.)

Poisoning.—This is placed among the probable means of perpetrating child-murder, but we rarely hear of *new-born* children being thus destroyed. The earliest age at which I have known a trial to take place, for the murder of a child by poison, was two months. (*R.* v. *South*, Norf. Aut. Circ. 1834.) A quantity of arsenic was given to an infant, and it died in three hours and a quarter after the administration of the poison. At this age, the case can scarcely be called one of infanticide, in its medico-legal signification; because all that it would be necessary to prove would be the cause of death,—the question of life or live birth would not require to be entered into. If, in a case of child-murder, death from poison should be suspected, it must be sought for in the usual way.

Examination of the mother.—The duties of a medical witness, as they relate to the *mother* of the child, generally the accused party, are slight. All that he is required to do is to show, by an examination made under an order from proper authority, whether or not she had been recently delivered of a child, and to state the probable period at which the delivery took place. (See post, DELIVERY.) This examination may be necessary in order to connect her delivery with the period which may have elapsed since the birth and death of the child. Unless the examination of the female be made within twelve or fifteen days, no satisfactory evidence of delivery can in general be obtained. It has happened, on more than one occasion, that medical men have assumed to themselves the right of enforcing an examination of a suspected female, and, by threats or otherwise, have compelled her to undergo this. Such a course of conduct is in the highest degree indecent and improper:—if a female willingly consent to the examination, or an order be obtained from a magistrate or other official person, the case is different. In taking this authority upon himself, a medical practitioner is forcibly compelling an accused party to produce positive proof of her guilt,—a principle which is entirely opposed to the spirit of English jurisprudence.

Conclusions.—The following conclusions may be drawn from the preceding remarks:—

1. That congestion of the face and head, in a new-born child, is not a proof of death from strangulation.
2. That strangulation can only take place in children which have breathed.
3. That a child may be strangled during birth by the accidental twisting of the umbilical cord round its neck.
4. That the umbilical cord may produce a livid or ecchymosed depression on the neck, like any other ligature.
5. That marks on the neck, arising from accidental causes, may resemble those which arise from strangulation.
6. That the effect of constriction on the neck, either by the umbilical cord or any other ligature, is the same if the child be *living*, whether it has or has not breathed.
7. That the effect is the same whether the child has been *partially* or *entirely* born.

8. That the effect of a ligature on the neck of a living child is the same, whether the umbilical cord has or has not been severed.

9. That a new-born child may die from strangulation, without this being necessarily indicated by ecchymosis on the neck. This depends on the nature of the ligature, and the amount of force used.

Summary. Frequent acquittals, in spite of medical evidence of criminality. —From the foregoing considerations it will be seen, that the two great points to be established by medical evidence, in a case of child-murder, are,—1st, that the child was *entirely born living* when the alleged violence was applied to it; and, 2d, that its death was due *to that violence, and to no other cause whatever.* The leniency with which such cases are regarded by the law, and the extreme rigour with which the medical evidence of *live-birth*, as well as of the *cause of death*, is treated, must show that they who consider that the use of the hydrostatic test can ever lead to the conviction of an innocent woman, have taken a very limited and incorrect view of the subject. The question of murder rests here, as in all other cases, upon clear and undoubted proof of the cause of death;—and more than this, it must be shown that the violence was *criminal*, and not by any possibility accidental. Then it should be proved that this violence, if criminal, must have been applied to the body of a child at a particular period—*i. e.* after entire birth; a case which, from what has already been stated, can rarely admit of clear medical proof. If strangulation, for example, be rendered probable from the facts, the woman cannot be convicted, unless proof be afforded, 1st, that the child was strangled after its entire body was born;—and, 2d, that she could not possibly have produced the marks of strangulation in her convulsive or half-conscious attempts at self-delivery. Medical evidence can rarely be in a condition to establish either of these points, and the assumptions will therefore be, as in the numerous cases already reported, in favour of the prisoner. A serious question will probably here suggest itself, from the number of *impossible* proofs, so to term them, which the law requires in these cases, namely—How can a conviction for child-murder ever take place where there are no eye-witnesses to the crime? The answer is, that these difficulties may not be raised in the prisoner's favour; but this of course is a matter of accident. On most charges of infanticide, if the counsel for the defence insisted upon distinct medical proof of the child having been *entirely born alive* when the violence was offered to it; or that respiration, if clearly established by evidence, took place, not during labour, but after complete birth, or after the child had acquired an independent circulation; —neither of these proofs could be possibly afforded; and the case, so far as medical evidence was concerned, would fall to the ground. That this is not an exaggerated view of the subject, will be evident from the following case, tried at the Lancaster Lent Assizes, 1846 (*Reg.* v. *Hacking.*) A female servant was charged with the murder of her infant child. The evidence went to prove that she had attempted to conceal her pregnancy. It was ascertained that she had been delivered of a child, and the medical evidence was to the effect, that its throat had been cut by some thin-bladed sharp instrument—*a portion of the gullet and wind-pipe having been cut away.* The prisoner stated that the child was born dead, and confessed that she had, as she believed, cut its throat with a pen-knife, which she had afterwards wiped and put away. The weapon was found in her pocket. The medical witness deposed, that the child had certainly *breathed*, and he was inclined to think it probable that it had been *born alive.* He admitted that a child may breathe when partially born, and die before it is wholly born; also, that the appearance of the wound, whether inflicted before or immediately after death, would be very similar; and it was impossible, from the examination of it, to say whether the child had been partially or wholly born at the time of its infliction. The counsel for the prisoner contended that no evidence had been adduced which could satisfy the jury that the child had been *fully*

born alive;—a circumstance without which the charge must fall to the ground. The jury acquitted the prisoner of the murder. (Med. Gaz. xxxvii. 382.)

In examining this case, it may be observed, that such a wound with a penknife was hardly likely to have been inflicted on the child by any accident, or for the purpose of aiding its expulsion during delivery. As the child had breathed, it is absurd to suppose that the woman waited until it had died from some other cause, of which there was no appearance; and that after death, without any conceivable motive, she cut out a portion of its throat. So far as the report goes, the acquittal appears to have depended on the allegation that the child was destroyed before it was wholly born; and although it had breathed, there was a want of evidence to show that this breathing had continued after it was entirely in the world. (See also another case in the same vol. p. 1007; and Prov. Med. Journ. April 2, 1851, p. 182.)

The frequent acquittals which take place on charges of child-murder, in spite of strong evidence of criminality, most probably depend on the fact, that there are many extenuating circumstances in the prisoner's favour. She may be young, unfortunate, friendless, and perhaps tempted by a seducer, or by utter destitution, to the perpetration of the crime. According to the present state of our law, the jury have no alternative but to convict her of a capital offence, or acquit her of the charge of murder, and find her guilty of the concealment of birth, the extreme punishment for which is two years' imprisonment. This is substantially the punishment at present inflicted for the crime of infanticide in this country; for it is not to be concealed that, *medically* speaking, these technical points relative to "live birth," to "entire birth," or to an "independent circulation in the child," or lastly, "concealed birth," are only so many ingenious means for evading convictions on the capital charge. Whatever doubt may exist according to the forms and principles of law, there can be no doubt, medically, that living children are often criminally destroyed, and that the law, from the severity of the punishment attached in all cases to the crime, cannot reach the perpetrators. In most of these cases the punishment of death would be as much too severe, as the punishment of two years' imprisonment for "concealed birth" is too slight; and with a full contemplation of this difficulty, the Civil Code of France (Art. 319) wisely permits the court, on proof of extenuating circumstances, to mitigate the punishment. Some such provision is required in our law; and the unnecessary perplexities which are now thrown on medical evidence, as well as the conflicting opinions on what is live birth and what is not, would then disappear. A change of this kind might undoubtedly be made, without prejudice to the accused, or interference with the course of justice.

It is a question which it would be here out of place to discuss, whether a verdict of manslaughter might not be proper on many of these occasions; for to say that the whole offence consists in concealing the birth of a still-born child, is virtually to disbelieve and reject the clear and satisfactory medical evidence often adduced. A verdict of manslaughter would not, however, cover those numerous cases where it is *assumed* that the child only lived to respire during the act of birth, and not afterwards. Dr. Christison, in commenting upon the frequent acquittals on the capital charge, and convictions only on a minor offence, which cannot always be proved, attributes it to a feeling sometimes entertained in the present day, that the killing of a new-born child, when perpetrated under the impulse of injured honour and the fear of disgrace, should not be classed with the other varieties of murder. (See Ed. M. and S. J., xxvi. 76.) There can, I think, be no doubt that this is the true explanation. (See also case by Mr. Coales, G. H. Rep., April, 1842.)

It may be mentioned, in concluding this subject, as the point has given rise to a trial for malapraxis, that if injuries should be criminally inflicted on a child during birth, and the child be born alive and afterwards die from the injuries so caused, the case would be murder or manslaughter, according to the circum-

stances. The following instance is reported by Chitty (Med. Jur. 416; also Archbold, 345:)—A man of the name of *Senior*, who, it appears, was an unlicensed medical practitioner, was tried, in 1832, for the manslaughter of an infant, by injuries inflicted on it at its birth. The prisoner practised midwifery, and was called on to attend the prosecutrix, who was taken in labour. The evidence showed that when the head of the child presented, the prisoner, by some mismanagement, fractured, and otherwise so injured the cranium, that it died immediately *after* it was born. It was argued in defence, that as the child was not born (*in ventre sa mère*) at the time the wounds and injuries were inflicted, the prisoner could not be guilty of manslaughter. The judge, however, held that as the child was born *alive* and died, the case might be one of manslaughter. This opinion was afterwards confirmed by the other judges, and the prisoner was convicted and sentenced to imprisonment. From the decision in this case, it will be seen that the law makes the question of criminality to depend upon the period at which the injuries prove *fatal*, and not upon the time at which they are inflicted on the body of a child. The decision appears to depend on this principle of the criminal law, that the person killed must be a reasonable creature in being, and under the king's peace:—therefore to kill a child in its mother's womb is no murder. (Archbold, 345.) The child, unless born alive, does not come under the description above given. Admitting the wisdom of adopting some fixed rule of this kind in a legal view, it is undoubtedly proper that the lives of children in the act of birth should be protected;—at any rate, that their destruction should not be treated, as it now appears to be, with perfect impunity.

If a child be born alive, as a result of criminal abortion, and die, not from any violence applied to its body, but as an effect of its being immature, this will be sufficient to render the party causing the abortion indictable for murder.

It is difficult to determine the number of cases of infanticide which take place annually in this country; but in France, where criminal statistics are more closely attended to, there were, in 1838, one hundred and twenty-nine cases; and in 1841, one hundred and forty-seven cases. (See Annales d'Hygiène, Oct. 1840.) [According to newspaper reports, child-murder has been for some time past alarmingly increasing among the working classes in England. A desire to escape the expense of supporting their offspring, and to obtain the fee to which they thus become entitled as members of burial clubs, are said to be the motives by which the wretched parents are induced to commit the crime.—H.]

PREGNANCY.

CHAPTER XLVII.

PREGNANCY IN ITS LEGAL RELATIONS—CASES OF RARE OCCURRENCE—SIGNS OF PREGNANCY—SUPPRESSION OF THE MENSES—PROMINENCE OF THE ABDOMEN—CHANGES IN THE BREASTS—QUICKENING—UNCERTAINTY OF THE PERIOD AT WHICH IT OCCURS—SOUNDS OF THE FŒTAL HEART—KIESTEIN IN THE URINE—CHANGES IN THE OS AND CERVIX UTERI—FEIGNED PREGNANCY—DE VENTRE INSPICIENDO—PLEA OF PREGNANCY IN BAR OF EXECUTION—THE JURY OF MATRONS AND THEIR MISTAKES—CONCEALMENT OF PREGNANCY A CRIME IN THE SCOTCH LAW—PREGNANCY IN THE DEAD—PREGNANCY IN A STATE OF UNCONSCIOUSNESS.

Pregnancy. Legal Relations.—The subject of pregnancy, in so far as the proofs of this condition in the *living* female are concerned, very rarely demands the attention of a medical jurist. Some exception has been taken to this opinion; but having now for a considerable period collected some hundreds of cases, which have been the subject of inquisition or trial in England and Wales, I find that there are but very few in the whole collection, in which the signs of pregnancy became a matter of evidence; and in some of these, the fact of pregnancy was actually referred to the decision of a jury of women, and not to a medical man! In relation to medical practice or to midwifery, the subject is undoubtedly one, the importance of which cannot be overrated; but this is entirely foreign to the object of this work, which is solely that of examining medical subjects in their strictly *legal* relations. The remarks here made are therefore brief; and for additional information on the subject, I must refer the reader to an excellent article by Dr. Montgomery, in the Cyclopædia of Practical Medicine, and to the standard works on Midwifery. If we except the very few instances in which a magistrate requires an opinion from a medical man respecting the pregnancy of a pauper female brought before him, there are only two cases in the *English* law in which pregnancy requires to be verified; and these so seldom present themselves, that the questions connected with the pregnant state rather belong to the science, than the practice of medical jurisprudence.

SIGNS OF PREGNANCY.

Suppression of the menses.—It is well known that in the greater number of healthy females, so soon as conception has taken place, this secretion is arrested. But there are certain abnormal conditions, which must not be overlooked. There are some cases recorded which show that women, in whom the menses have never appeared, may become pregnant. This, however, is allowed by all accoucheurs to be rare; and when it occurs, which we may readily learn from the account of the female, it will be proper to search for other signs in order to determine the question of pregnancy. Irregularity as to the period at which the secretion takes place is very common among females. This irregularity may depend either upon the age of the party, or upon disease, either of which causes it will not be difficult to recognise. It is well known that there are numerous disorders of the

uterus under which, irrespective of pregnancy, the menses may become suppressed. The absence of the menstrual discharge as a consequence of pregnancy is generally indicated by the good health which a female enjoys;—and although disease may coincide with pregnancy, yet an acute practitioner will be able to estimate from the symptoms to what cause the suppression is due. On the other hand, a discharge perfectly analogous to the menstrual, sometimes manifests itself, not merely for several periods in a pregnant woman, but during the whole course of pregnancy. (Dr. Murphy's Obstetric Report, 1844, p. 9; also, Henke, Zeitschrift der S. A., 1844, 265.) Mr. Whitehead has collected seven well marked cases of menstruation during pregnancy. (On Abortion, 218.) These facts show that we must be cautious in our diagnosis, and not declare, that, because a discharge continues, pregnancy cannot possibly exist, or that because it is suppressed, the female must be pregnant.

Feigned menstruation.—The menses may be really suppressed; but if there be any strong motive for the concealment of her condition, the female may feign menstruation. Dr. Montgomery detected a case of this kind by an examination of the areolæ of the breasts. The woman had stained her linen with blood, in order to make it appear that the menses continued; but she subsequently admitted that this was an imposition. It has been stated that there are differences between menstrual and ordinary blood, but there are no certain chemical means of distinguishing them. (See BLOOD-STAINS, ante, p. 222.)

Prominence of the abdomen.—A gradual and progressive enlargement of this cavity is one of the most well marked consequences of pregnancy. The skin becomes stretched, and the navel almost obliterated. The enlargement in general begins to be obvious about the third month, although there are some females of peculiar organization, in whom the enlargement may not become perceptible until the fifth or sixth month, or even later: still it may be detected on examination. In fact, this sign can never be absent in pregnancy, although it may not be so apparent in some females as in others. The objection which exists to it is, that numerous morbid causes may give rise to prominence of the abdomen. This is undoubtedly the fact,—as we have occasion to witness in ascites, ovarian dropsy, or in amenorrhœa,—diseases which, in several instances, have been mistaken for pregnancy by eminent practitioners. On the other hand, instances are not wanting, in which, owing to the persistence of menstruation, and the absence of quickening, the gravid uterus has been actually tapped, by mistake, for an ovarian tumour; the operation being speedily followed by the birth of a full-grown child! (See Whitehead on Abortion, p. 186;) but the history of the case will in general enable a practitioner to form a diagnosis. (An interesting case of amenorrhœa strongly simulating pregnancy, is reported by Dr. Rüttel, Henke, Zeitschrift, 1844, 240.) The enlargement may be owing to disease when it has been observed by the female for a time longer than the whole period of gestation: it may have been accompanied by a generally diseased condition of the system, and an absence of the other symptoms of pregnancy. The most embarrassing cases are unquestionably those in which abdominal disease coexists with pregnancy. Here time alone can solve the question, and the medical jurist should give the benefit of his doubt to the side of chastity, mercy, and humanity. (On an important case in which an abdominal tumour was mistaken for pregnancy, see Lancet, Oct. 16, 1847, p. 408.) While the abdomen enlarges from pregnancy, the margins of the abdominal muscles become more clearly defined. The umbilicus is less depressed, and gradually acquires the level of the surrounding skin. As pregnancy advances, it becomes more prominent, and in the last month it assumes the character of a tumour, instead of a depression. (Whitehead, loc. cit. 209.)

A change in the breasts.—These organs in the pregnant female become full and prominent, and the areolæ around the nipples undergo changes which Dr. Montgomery, and others, regard as highly characteristic of the pregnant state.

A mere fulness or pain in the breasts, and even in some rare instances the secretion of milk, may arise from other causes than pregnancy. Severe uterine irritation may cause the breasts to become painful and swollen. The fulness of the breasts from pregnancy is not commonly observable until about the second or third month; and with regard to the secretion of milk in non-pregnant females, the few rare cases of its occurrence on record show that it takes place under circumstances which cannot well be mistaken for the pregnant condition. (See Henke, Zeitschrift der S. A., 1844, 269.) The *areola* is generally observed, during pregnancy, to become considerably darker in colour, and larger in diameter. The skin of which the areola is formed becomes soft, moist, and slightly tumid. The little glandular follicles about it are prominent, and often bedewed with a secretion:—among these changes, that of *colour* has been the most attended to. They are commonly well marked in from the second to the fourth month of pregnancy,—the intensity of colour being the last condition of the areola to appear. The prominence of the glandular follicles does not always exist in pregnancy, and the areola may become large and dark-coloured from other causes; consequently, these signs are only to be looked upon as corroborative. In females of dark complexion, the areolæ are dark, irrespective of pregnancy; and in some cases of advanced pregnancy these changes in the areolæ are entirely absent. (Edin. Month. Journ., March, 1848, 693.) Dr. Montgomery has recently described, as a sign of pregnancy, the existence of a *brown line* extending from the pubes to the umbilicus, especially in females of dark complexion, and a dark-coloured but not raised areola of about a quarter of an inch in breadth, around the umbilicus.

Quickening.—The signs above given are applicable to the early as well as to the late stages of utero-gestation: but that which we have here to consider is one which is rarely manifested until about the fourth or fifth month. Quickening is the name applied to peculiar sensations experienced by a female about this stage of pregnancy. The symptoms are popularly ascribed to the first perception of the motions of the fœtus, which occur when the uterus begins to rise out of the pelvis; and to this change of position the sensation is perhaps really due. The motions of the fœtus are perceptible to the mother before they are made evident by an external examination. The term is derived from the old Saxon word "quick," signifying living, as, at the time when medicine was in its infancy, it was considered that the fœtus only received vitality when the mother experienced the sensation of its motions! On the occurrence of quickening, there is generally great disturbance of the system; indicated by syncope, nausea, and other distressing symptoms. After a short time the female recovers; and if sickness has hitherto attended the pregnant state, it has been frequently observed to disappear when the period of quickening is past.

No evidence but that of the female can satisfactorily establish the fact of quickening, and this it is important to bear in mind; since, in some cases in which pregnancy becomes an object of medico-legal interest, proof of quickening is demanded by the law. The discovery of the motions of the child by an examiner is really a proof that the usual period of quickening is past, but their non-discovery, at the time of examination, is no proof whatever that the woman has not quickened; since the motions are by no means constant, and may be accidentally suspended even at several successive examinations. Besides, cases every now and then occur, in which well formed, healthy females do not experience the sensation of quickening during the whole course of pregnancy; and, what is of more importance, the motions of the child may be at no time perceptible to the examiner. The uncertainty of quickening, as a sign of pregnancy, is too well known to require more than adverting to. Females have been known to mistake other sensations for it, and in the end it has been proved that they were not pregnant. A woman may also declare that she has felt quickening when she has not; and unless the motions of the child be perceived by the examiner at the time, how is he to disprove her statement? Quickening, then, (so far as it concerns

the statement of the female) cannot be relied on as a proof of pregnancy; but if the motions of the child can be felt by the examiner through the abdominal parietes, this is clear evidence, not only of the woman being pregnant, but of her having passed the period of quickening. We may next consider the period of pregnancy at which this symptom ordinarily occurs. Our law seems to infer, that it is a constant, uniform, and well marked distinction of the pregnant state; and in some instances insists upon proof accordingly. Taking the general experience of accoucheurs, quickening happens from the tenth to the twenty-fifth week of pregnancy; but the greater number of instances occur between the *twelfth* and *sixteenth* week;—or between the fourteenth and eighteenth week after the last menstruation. It is a popular opinion that quickening takes place exactly at the end of four calendar months and a half; but it mostly occurs two or three weeks earlier than this period. Many females estimate that they are four months advanced in pregnancy when they quicken; but this mode of calculation is open to numerous fallacies. Dr. Rodrique knew a lady who invariably quickened at two months, and went full seven months after, with all her children,—five in number. (Amer. Journ. Med. Sci., Oct. 1845, p. 339.)

From these observations, it will be seen that an examiner may sometimes detect the *motions of the child* about the third or fourth month,—at others not until the fifth or sixth;—and in other instances not at all, throughout pregnancy. Even in those cases in which the motions of the child have indisputably existed, they are not always to be perceived: hence several examinations should be resorted to, before an opinion is expressed from their absence. In making these examinations, the diagnosis is often facilitated by previously immersing the hand in cold water, and then suddenly applying it to the abdomen. When the motions of the child are distinctly perceived through the parietes of the abdomen, they constitute a certain sign of pregnancy; but their non-discovery at a particular time is no proof that the female is not pregnant. The jury of matrons probably trust to this sign: hence their verdicts commonly turn out to be erroneous.

Sounds of the fœtal heart.—Another sign is that which is derived from *auscultation*. By the application of the ear, or a stethoscope, to the abdomen, at about the fifth month of pregnancy, rarely earlier, the pulsations of the fœtal heart may be recognised and counted. These pulsations are not synchronous with those in the arteries of the mother; they are much more rapid, and thus it is impossible to mistake them. Their frequency, according to Dr. Hope, is in an inverse ratio to the stage of gestation, being 160 at the fifth, and 120 at the ninth month. This sign, when present, (like the motions of the child,) not only establishes the fact of pregnancy beyond all dispute, but shows that the child is living. The sound of the fœtal heart is, however, not always perceptible: when the child is dead, of course it will not be met with: but its absence is no proof of the death of the child, because the hearing of the pulsations by an examiner will depend very much upon the position of the body, the quantity of liquor amnii, and other circumstances. Thus it may be distinctly heard at one time, and not at another. It may be absent for a week or fortnight; and then will reappear;—so that, although its presence affords the strongest affirmative evidence, its absence furnishes very uncertain negative evidence; and several examinations must be made in the latter case, before an opinion is drawn. The earliest time at which the pulsations may be heard has been stated to be about the fifth month; but they will be best heard between the sixth and eighth. The reason why the sound is not always perceived, is owing not only to changes in the position of the child, but to the vibrations having to traverse the liquor amnii and the soft parietes of the abdomen. The point of the abdomen where the sound can be best heard is in the centre of a line drawn from the umbilicus to the anterior inferior spinous process of the ilium on either side—perhaps most commonly on the right. When clearly detected, it is the most unequivocal sign

of the pregnant state. Besides the sound of the fœtal heart, auscultation has led to the discovery of what is called the placental murmur. This sound is more likely to create fallacy than that of the fœtal heart.

Kiestein in the urine.—A substance called *Kiestein* has been found in the urine of pregnant females. It appears as a fatty iridescent pellicle on the surface of the urine about twenty-four hours after it has been voided. There are various opinions concerning the nature of this substance, some regarding it as a mixture of casein and oil with earthy phosphates, (Dr. Bird, G. H. Rep., April, 1840, p. 26,) and others as a modification of albumen (L'Héritier, Chimie Pathologique, 483.) From the late researches of Dr. Möller, its presence in the urine is subject to so much uncertainty, that it is wholly unfitted to serve in medical jurisprudence as a diagnostic character of pregnancy (Casper's Wochenschrift, ii. 1845, S. 21.) Dr. Mickschick has arrived at the same conclusion (Med. Gaz., xxxix. 264.) Mr. Kane obtained kiestein in equally great quantity from the urine of a virgin aged fourteen, and that of a woman who had nursed for two months (Whitehead on Abortion, 231.) Dr. Golding, however, entertains a high opinion of its value as a sign of pregnancy in its earlier stages when the other signs are obscure. According to this gentleman, it is present in the urine at all periods of pregnancy—it is identical with milk in a crude form, and is to be regarded as a secretion of the mammary glands (Obstetric Record, 3, 45.) Dr. Rees has detected in it milk-globules, and considers it to be caseous matter altered by passing through the kidney (Anal. of Blood and Urine, 217.)

In reference to the above signs, it may be observed, that if the motions of the child or sounds of the heart be perceptible, no other evidence of pregnancy need be sought for. The mere suppression of the menses, prominence of the abdomen and fulness of the mammæ, cannot alone establish the fact; but, unless the morbid causes of these abnormal states of the system be clearly and satisfactorily obvious to the examiner, it is a fair presumption that the female is pregnant. In every case where a doubt exists, we should require sufficient time for a clear diagnosis.

Changes in the os and cervix uteri.—The signs hitherto mentioned are chiefly relied on in medical practice; but it must be remembered that no case can possibly occur in civil or criminal jurisprudence, in which it will not be in the power of a medical witness to make an examination of the female. He may then form a safe diagnosis from the changes which take place in the cervix uteri, and from the sensation imparted to the finger by the presence of a rounded body (like the fœtus) floating in a liquid, when an impulse is given to the uterus from below. Up to the fifth or sixth month of pregnancy, the neck of the uterus may be commonly felt projecting into the vagina; it is of its usual length, hard and firm,—after that period the uterus rises into the pelvis, and the neck becomes spread out, shorter and softer, the aperture increasing in size and becoming rounder. Towards the end of gestation, the neck of the uterus appears to be lost, becoming like a thin membrane, and sometimes no aperture can be felt.

A well marked test of pregnancy is the motion perceptible to the finger on giving a sudden impulse to the neck of the uterus. Capuron calls this the touchstone in the diagnosis of the pregnant state:—without it, he considers the medical jurist may be easily deceived. To this passive motion of the child, the name of *ballottement* is given. It cannot be easily determined before the fifth or sixth month; but after the latter period, especially as pregnancy becomes advanced, it is always available. In the French schools, the method of applying the *toucher* and *ballottement* to pregnant females is systematically taught, and by a little practice it may be easily acquired.

As most of these signs refer to an advanced stage, a witness may be asked what are the unequivocal indications of pregnancy *before the fifth or sixth month?* The answer to this question is of little moment to the medical jurist, since he is rarely required to give an opinion under these circumstances. In all *legal* cases,

when pregnancy is alleged or suspected, it is the practice for the judge or magistrate, on a representation being made by the medical witness, to postpone the decision one, two, or three months, according to the time required for obtaining *certain evidence*. This evidence will consist in plainly distinguishing a rounded body floating freely in the uterus, as well as the motions of a fœtus. The most experienced men agree, that before the *sixth month*, the changes in the cervix and os uteri are of themselves too uncertain to enable an examiner to form a safe diagnosis; and à fortiori it is impossible to trust to external signs. Mr. Whitehead dissents from this view, and considers that a specular examination of the mouth of the uterus is not only more satisfactory than any other mode of exploration, but that it will enable a person to determine with certainty the existence of pregnancy during its earlier stages—from a few days after conception to the middle or end of the fourth month, when auscultation first becomes available. In the *fourth week* the labia of the os at the centre of their margin become permanently separated to the extent of one or two lines; and the os tincæ itself, which was before a mere chink with parallel boundaries, forms an elliptical, or sometimes rounded aperture, which is occupied by a deposit of transparent, gelatinous mucus. At *six or eight* weeks it becomes decidedly oval or irregularly circular, with a puckered or indented boundary, having a raised and lobulated character. The whole circumference of the cervix is enlarged, and, the commissures or angles of the os tincæ are obliterated. The os continues of this irregular form throughout the whole period of gestation; but from the period of quickening to the end of the seventh month the progressive changes are not so marked as to form a guide for determining the period of pregnancy. (On Abortion, 204.) This condition of the os uteri must not be confounded with its menstrual state in the early stages, nor with a diseased state in the later stage of gestation.

Feigned pregnancy.—Pregnancy is sometimes feigned or simulated for the purpose of extorting charity, of obtaining a settlement in a parish, or of compelling marriage; but it is scarcely necessary to observe, that the imposture may be easily detected by a well informed practitioner, since the woman always feigns an advanced stage of pregnancy. Although she may state that she has some of the symptoms depending upon pregnancy (and, unless she has already borne children, she will not be able to resist a cross-examination even respecting these), yet it is not possible for her to simulate without detection a prominence of the abdomen or the state of the mammæ. If she submit to an examination, the imposition must be detected: if she do not, the inference will be that she is an impostress. Pregnancy may be feigned by a female in order to avoid being sent by a magistrate's order to a distant parish, or to escape the punishment of hard labour, to which she may have been sentenced. If in the latter case the slightest doubt should exist whether the female be really pregnant or not, an affirmative opinion should be given, at least for a time, since very great and irreparable mischief might result by taking an opposite course.

In civil cases of feigned pregnancy, an examination should always be insisted on, or the reputation of a practitioner may suffer by his giving a hasty opinion on the subject. In this respect the case of *Devonald* v. *Hope*, Q. B., December, 1838, is of some interest. A medical man having given opinion that a female patient was pregnant, subsequently brought an action against her for medical attendance. It turned out, however, that she was not pregnant, and that there were no satisfactory medical grounds upon which his opinion was based. The plaintiff complained of having been deceived by the female as to her condition; but it is obviously in the power of every medical man to prevent such a deception being practised on him. An external examination only, will not suffice either to affirm or negative the allegation of pregnancy, except where it is stated to be far advanced. For a singular case in which, on a charge of assault, evidence of this kind was tendered, see Med. Gaz. xxxvi. p. 1083, 1169. On the fallacy of

the signs of pregnancy, and the simulation of this state, see a paper by M. Tardieu, Ann. d'Hyg., 1845, ii. p. 429; also 1846, i. 83.

De ventre inspiciendo.—One of the cases in the English law, in which pregnancy requires to be verified, is of a civil nature. It is in relation to the Chancery writ "*de ventre inspiciendo.*" A woman may assert that she is pregnant at the time of her husband's death, and the heir at law may sue out a writ to require some proof of her alleged pregnancy, as his right to the estate of which the husband died possessed may be materially affected by the result. Until within a recent period, the decision of the question of pregnancy was left to twelve matrons and twelve respectable men, according to the strict terms of the ancient writ; but in one of the most recent cases, it was considered advisable to depart from this absurd custom, and to place the decision in the hands of medical practitioners.

In May, 1835, a gentleman named *Fox* died, leaving a widow, to whom he had not been married more than six weeks. By his will, made some months before his death, he left the great bulk of his property to the use of Ann Bakewell, spinster, for the term of her natural life, so long as she remained sole and unmarried; and after her decease or marriage, to one John Marston. Soon after the making of the will, this Ann Bakewell became the wife, and subsequently the widow of Mr. Fox. Notwithstanding that she had married the testator himself, the plaintiff Marston claimed the property from the widow, on the ground of her having infringed the terms of the will by her marriage with the testator! She pleaded pregnancy, and in August, 1835, the writ "*de ventre inspiciendo*" was sued out of chancery by Marston. Some discussion took place in court as to whether the writ should be issued in its original indelicate form or not; *i. e.*, whether the female should undergo examination by the sheriff, assisted by twelve matrons and twelve respectable men! The widow petitioned the court not to issue the writ; and put in an affidavit from her ordinary medical attendant, to the effect that she was pregnant and too weak to undergo the proposed examination. Ultimately it was decided that two matrons, with a medical man on each side, should visit Mrs. Fox once a fortnight until her delivery. There was no doubt of her pregnancy, and she was delivered at the due time, to the great disappointment of the residuary legatee. (See Med. Gaz. xvi. 697; xvii. 191.) The nature of this judicial examination will be understood by quoting the terms of the writ addressed to the sheriff. "In propriâ persona tuâ accedas ad præfatam R. et eam coram præfatis videri et diligenter examinari et tractari facias per ubera et ventrem omnibus modis quibus melius certiorari poteris utrum impregnata sit necne." (*Register Brevium.*) There can of course be no difficulty in forming an opinion in such a case, provided the pregnancy be at all advanced. It is, however, not a little singular, that in the present day any attempt should be made to apply the feudal customs of a rude and barbarous age to the determination of questions which belong to an exclusively advanced state of medical science.

Plea of pregnancy in bar of execution.—The second case in which pregnancy requires to be verified in English law, is in relation to criminal jurisprudence. When a woman is capitally convicted, she may plead pregnancy in bar of execution. The judge will then direct a jury of twelve married women, "*de circumstantibus,*" to be impannelled, and sworn to try, in the words of the law, "whether the prisoner be with child of a quick child or not." If they find her quick with child, she is respited; otherwise the sentence will take effect. In admitting the humanity of the principle by which a pregnant woman is respited until after delivery, there are two serious objections to the practice of the common law, whereby it is made to fall far short of what, in a civilized country, society has a right to expect from it: these are, 1, that the question of pregnancy is allowed to be determined by a jury of ignorant women accidentally present in Court; and 2d, that the respite is made to depend, not upon proof of pregnancy, but

upon the fact of the woman having quickened! This sign of the pregnant state has been known to occur so early as the third, and so late as the sixth month: some females have even reached the seventh month without observing it: hence, the infliction of capital punishment, under these circumstances, becomes a matter of accident. Quickening is a sign not easily established, except by extorting a confession from the female; and this is the only possible way in which, in a doubtful case, the question could be determined by a jury of matrons. They commonly trust to feeling the motions of the child externally, but this at particular times is a purely accidental circumstance. It must be obvious, on the least reflection, that the means resorted to by the English law to determine such a question are bad, and quite unfitted for the present state of society. Several modern cases show that a jury of matrons may be very easily deceived with respect to this sign of pregnancy. In the case of *Rex* v. *Wright*, the prisoner was found guilty of the murder of her husband by poison. She pleaded pregnancy in bar of execution. The judge impannelled a jury of matrons; and they, after a form of examination had been gone through, brought in a verdict of *not quick* with child. The woman would have been executed, had not several medical practitioners of Norwich represented to the judge that the method taken to determine pregnancy and quickening, was so unsatisfactory, that no reliance should be placed upon it. The prisoner was then examined by some medical men, and was found to have passed the usual period of quickening! The judge respited the prisoner, and the correctness of the medical opinion was confirmed by the female being delivered, within four months afterwards, of a healthy full-grown child. (See Med. Gaz. xii. 22, 585; *Rex* v. *Wright*, Norwich Lent Assizes, 1832.) In a case tried in March, 1838, a woman was convicted of murder, and pleaded pregnancy. A *medical* opinion was here required. The pregnancy, if it existed, had so little advanced, that the practitioner was unable to give a satisfactory report; and the judge respited the prisoner for a month, in order that the witness might have full opportunity to ascertain the fact. Still the jury of matrons is occasionally resorted to. Thus in the case of *Reg.* v. *Westwood*, (Stafford Winter Assizes, 1843,) the matrons were summoned to examine a female capitally convicted, and they negatived the plea! It is not a little remarkable that, although in so many cases the matrons have given a wrong verdict, and that in no instance can they give a right one except as a matter of pure conjecture, the practice still continues. Thus this antiquated system was again revived at the Central Criminal court, in 1847. (*Reg.* v. *Hunt*, September, 1847.) This woman was convicted of murder: she pleaded pregnancy, and the matrons were impannelled and directed to use "their best skill" to determine whether the prisoner "was big with a quick child or not." It was left to their option to have the assistance of a surgeon. In half an hour they returned a verdict "that she had not a living child within her." The law was directed to take its course, and the woman would have been executed, but for the interference of the Secretary of State. He directed that the prisoner should be examined by competent medical men, who ascertained that she was really pregnant, and had passed that stage at which quickening is most commonly perceived. She was therefore respited, and the error in the verdict of the matrons was clearly proved by the birth of a child on the 28th December!

It is unnecessary in the present day to discuss the question, whether, until the period of quickening, the child be or be not "*pars viscerum matris.*" The vulgar opinion is, that the fœtus only receives life when the woman quickens: but the law should not base its decisions in reference to capital punishment upon vulgar opinions. As ovum, embryo and fœtus, the contents of the uterus are as much endowed with special and independent vitality in the earlier as in the later periods of gestation. It is, then, absurd to fix upon an accidental and uncertain symptom, occasionally felt by the pregnant female, as the point at which clemency may be shown. The bare proof of *pregnancy*, as in the law of France (Art.

xxvii. of the Penal Code) should be sufficient to authorize a suspension of the sentence. The doctrine of quickening has been abandoned in relation to the law of criminal abortion; and there is still greater reason for its immediate abolition in reference to pregnant females capitally convicted.

This change would, however, be attended with but little benefit if the decision of the question of pregnancy were still to remain in the hands of "matrons." The record of their mistakes sufficiently establishes the correctness of this view: for if they are unable to recognise the pregnant state at the fifth month, they cannot fail to be mistaken in their verdicts at earlier periods. It is, moreover, an extraordinary circumstance, that when married women advanced in pregnancy are themselves continually deceived, and are obliged to consult medical men respecting their condition, they should be specially selected by the law as the persons best qualified to pronounce an opinion upon the pregnancy of a female, in a case involving the infliction of capital punishment. It would be considered inhuman to execute knowingly a pregnant woman, but the imputation of inhumanity is not the less deserved by a law which virtually leaves the issue in the hands of ignorant and incompetent persons. The Americans are certainly in advance of us in their legislation on this subject. Thus by the revised statutes of New York, when pregnancy is pleaded in bar of execution, it is enacted that the sheriff shall summon a jury of *six physicians*, and shall give notice to the district attorney, who shall have power to subpœna witnesses.

These are, I believe, the only two cases in which pregnancy has any direct relation to medical jurisprudence; and it is remarkable, that with respect to them, the law of England has expressly provided that they should be left to the decision of non-medical persons! The following conclusions may therefore be drawn:—1. That the cases in which the signs of pregnancy become a subject of *legal* inquiry in *England* are exceedingly rare:—2. That there is no case in *English* law, in which the medical man will not have an opportunity of performing an examination *per vaginam*:—3. That a medical opinion is never required by English law-authorities, until the pregnancy is so far advanced as to render its detection *certain*. Hence discussions concerning areolæ, the condition of the breasts, the presence of kiestein in the urine, &c., are really unimportant to the medical jurist. By these remarks I do not intend to undervalue the importance of an accurate knowledge of the signs of pregnancy to a medical practitioner. Cases which may never come before a Court of Law will be referred to him, and the serious moral injury which he may inflict on an innocent female by an inaccurate diagnosis should make him scrupulously cautious in expressing an opinion. On this subject the reader may profitably consult a paper by Dr. Nelson (Lancet, November 22, 1851, p. 485.)

Concealment of pregnancy.—According to the law of Scotland, proof of pregnancy is required, in charges of concealed pregnancy, under the 49th Geo. III. c. xiv. This has rendered it necessary to establish this condition by the more common and outward signs, derived from the appearance of the woman's person, — *i. e.* by the areolæ around the nipples, the presence of milk in the breasts, &c.; but the Scotch juries wisely appear to place so little confidence in these signs, that in the only two cases quoted by Alison, (*Smith*, 1761; *Ferguson*, 1809,) they acquitted the females. (Criminal Law of Scotland, 154.) These casual and uncertain signs of pregnancy may be, however, of more importance in Scotch than in English practice. Dr. Seller, formerly the editor of a respectable Scotch journal, who did me the favour to notice the first edition of this work, appears to have entirely forgotten that there are any differences between the laws of Scotland and England in this respect; for he expresses perfect astonishment at the statement made by me, that (the signs of) pregnancy rarely demanded the attention of a medical jurist. The facts above mentioned appear to me to establish the correctness of this statement with respect to England; and that so eminent a writer on the Criminal Law of Scotland as Alison, was obliged

in 1832, to go back seventy years for a case in illustration, does not favour the view that questions connected with this subject are either frequently raised, or, when raised, create much difficulty in that country.

Pregnancy in a state of unconsciousness.—It was formerly a question whether a woman could become *pregnant* without her knowledge. This may undoubtedly happen, where intercourse has taken place during profound sleep (lethargy,) or where a female has been thrown into this state by narcotic drugs. But it is very difficult to admit that any woman should remain pregnant up to the time of her delivery, without being conscious of her condition, if the intercourse took place during the waking state. A woman endowed with ordinary intellect could not avoid *suspecting* her condition after the fourth or fifth month; and this alone would be sufficient to induce her to seek advice, whereby the fact would become known to her. When a woman is impregnated in a lethargic state, it is very unlikely that she should go beyond the sixth month without being fully aware of her pregnancy, as a female with innocent motives would undoubtedly make some communication to her friends. Capuron mentions a case of this kind, where the fact of pregnancy was first ascertained at the end of the fourth month, by the female having complained to one of her sisters of a strange sensation which she experienced in the lower part of her abdomen. (Méd. Lég. des Accouchemens, 86.) In a case related by Mr. Skey, a young female who had intercourse knowingly, was supposed not to have been aware of her pregnancy until the seventh month; but there is some reason to believe that the woman was guilty of deception. (Med. Gaz. xxxix. p. 212.) It is quite possible that women who are living in connubial intercourse may become pregnant without being conscious of it. Dr. Ruttel mentions the case of a female, æt. 41, who had been married upwards of sixteen years, and who while returning from a neighbouring village was suddenly delivered of her first child, when she had only a few days before been complaining that she was not likely to have any children. The child was born living and mature. (Henke, Zeitschrift der S. A. 1844, 264.) Many of these cases of alleged unconsciousness of intercourse and pregnancy are, however, quite unworthy of belief.

Pregnancy in the dead.—I am not aware of any case in law, wherein the *fact of pregnancy* requires to be verified after the *death* of a female. The discovery of an embryo or fœtus in the uterus would of course at once solve the question, when the necessity for an examination occurred. If the woman had obviously been pregnant, and the child was no longer in the womb, then several medico-legal questions may arise in reference to delivery.

[The main question of pregnancy in a female just dead, or found dead, may often be important as collateral evidence, and for other reasons. An interesting case, in which the inquiry was made long after death, is quoted by Dr. Beck in the Am. Jour. Med. Sci. July, 1852, 269, from Casper in the Med. Times, Nov., 1851. It is related by Casper "in exemplification of a point he has frequently illustrated, viz., the much longer exemption which the uterus obtains from putrefaction compared to other organs." A young woman was missed, and it was suspected that she was pregnant, and that her lover had made way with her. Nine months afterwards her body was found in a privy, having been macerated during that period in feces and urine. Notwithstanding the horrible condition the soft parts generally had been reduced to, Dr. Casper, convinced that he could recognise the fœtal bones if there were any, searched for the uterus, and found it of a light red colour, firm in texture, and of the normal size and form internally and externally of a non-pregnant organ. Thus if the investigation threw no light upon the cause of death, it at least wiped away an undeserved stain upon the poor girl's reputation. We are not told how the corpse was identified.—H.]

DELIVERY.

CHAPTER XLVIII.

DELIVERY IN ITS LEGAL RELATIONS—DELIVERY IN THE LIVING—CONCEALED DELIVERY—ABORTION IN THE EARLY STAGES OF PREGNANCY—THE SIGNS SPEEDILY DISAPPEAR—EARLY EXAMINATIONS—SIGNS OF RECENT DELIVERY IN ADVANCED PREGNANCY—EVIDENCE FROM THE SKIN OF THE ABDOMEN—THE ORGANS OF GENERATION—THE PRESENCE OF THE LOCHIA—SIGNS OF DELIVERY AT A REMOTE PERIOD—FEIGNED DELIVERY—DELIVERY IN A STATE OF UNCONSCIOUSNESS—CIRCUMSTANCES UNDER WHICH THIS MAY OCCUR—NATURAL AND MORBID SLEEP—ADMISSION OF THE PLEA IN CASES OF ALLEGED CHILD-MURDER—SIGNS OF DELIVERY IN THE DEAD—APPEARANCES OF THE INTERNAL ORGANS IN CASES OF RECENT DELIVERY—THEIR RAPID OBLITERATION—TRUE AND FALSE CORPORA LUTEA—FALLACIES TO WHICH THEY GIVE RISE—EXAMINATION OF THE OVUM OR EMBRYO—ITS CHARACTERS FROM THE FIRST TO THE SIXTH MONTH—ABORTION OF MOLES AND HYDATIDS. MEDICO-LEGAL CASES.

Legal relations.—Delivery is a subject which much more frequently requires medico-legal intervention than pregnancy. It will be sufficient to state, that the concealment of birth,—the crimes of abortion and infanticide, with questions relative to suppositious children, are closely dependent on the proof of parturition. This subject will admit of being considered under two heads:—1. As it relates to delivery in the *living;*—2. As it relates to delivery in the *dead.* In undertaking the investigation, we ought, if possible, to ascertain, either from the female herself or from those around her, whether there was reason to suspect that she had been pregnant. If we can acquire any knowledge on this point, it will materially facilitate our inquiry; but this is not always possible. It has generally happened, that previous pregnancy has been so concealed, that few who saw the woman suspected her condition: then again, as the admission of her delivery by a living female may be the strongest proof of her criminality, she will perhaps resolutely deny it; and a medical practitioner has no right to extort this admission from her. From this it will be seen, that a medical witness must often be prepared to prove the fact of delivery against the subject of the criminal charge.

Delivery in the living. Concealed delivery.—The signs of delivery in the *living* female will vary materially, according to the time at which that event has taken place. In common language, if the contents of the uterus be expelled before the sixth month, the woman is said to miscarry, or to have an abortion: if after the sixth month, she is said to have a premature labour. The law does not admit any such distinction: the expulsion of the ovum, fœtus, or child by criminal violence, at any period of utero-gestation, is regarded as a miscarriage or abortion. It will therefore be proper, in treating this subject, to commence with the earliest period at which the contents of the uterus may be expelled, and to make no artificial distinction between the signs of abortion and delivery. It has been well observed, that the signs of delivery are indistinct in proportion to the

immaturity of the ovum. Thus, when it takes place at the second or third month, there are scarcely any proofs which can be derived from an examination of the female. All the ordinary signs of delivery at the full period will be absent,—the development of the embryo not having been sufficient to cause any prominence in the abdomen, or to give rise to those changes in the system which take place previously to the birth of a mature child; *e. g.* enlargement of the mammæ, and dilatation of the os uteri. Abortion at this period (the second or third month,) is generally accompanied by a loss of blood, which may manifest itself by its effects on the body. This, however, can only give rise to a suspicion. At a later period of gestation there may be a discharge resembling the lochia, and the os uteri may be found enlarged and soft; but from the small size of the fœtus, the outlet will present no positive evidence of delivery. The quantity of blood lost may be greater, and may have a more decided effect on the system. Of course, if the ovum or fœtus be found, then the presumption of abortion is strongly supported; but those females who designedly conceal their condition will commonly take effectual means to prevent the examiner from obtaining evidence of this kind.

These remarks relative to the state of the female apply to an examination made *recently* after the abortion. If any delay take place (and this is a very common occurrence,) even the ambiguous signs which have been mentioned speedily disappear; so that after a period, which is short in proportion to the earliness of the expulsion, no trace whatever will be discovered. Dr. Montgomery met with a case, in which abortion took place with considerable hemorrhage at the close of the second month. Twenty-four hours afterwards, the os and cervix uteri were almost completely restored to their natural state. The vagina and external parts were hardly, if at all dilated, and very little relaxed; the breasts exhibited, very imperfectly, the appearances which accompany pregnancy, the ordinary sympathetic symptoms of which had been almost entirely absent. (Dub. Pr. Med. 504; Devergie, i. 682.) In such a case as this,—and for such cases the medical jurist must be prepared, scarcely a presumption could have been entertained of the fact of delivery. After twenty-four or thirty-six hours, in the greater number of cases of early abortion, we may expect to find, from a personal examination of the female, no proofs whatever of this event.

In order to determine the signs of a "miscarriage," as it is termed by our law, at an advanced period of gestation, it will be necessary to describe those which are considered to be characteristic of delivery at the full period. There will be, in these cases, only a difference in degree; the signs being more numerous and more clearly marked in proportion to the lateness of the period at which the contents of the uterus are expelled. The signs of delivery may be enumerated in the following order:

Signs of recent delivery in the living.—The female is weak, the countenance pale; the eyes surrounded by livid areolæ, and there is an appearance of general indisposition. Any severe illness may, however, give rise to similar symptoms. Their sudden occurrence from a state of previous good health, especially when pregnancy is known or suspected, will create a strong suspicion. The *breasts* are full, especially about the third or fourth day; the nipples are turgid, and the areolæ around them present all the characters of advanced pregnancy.

1. The *skin* of the abdomen is relaxed, sometimes thrown into folds; the colour interrupted by light-coloured broken streaks, passing especially from the groins and pubes towards the umbilicus; and the navel is more or less stretched and altered. The round form of the enlarged and semi-contracted uterus may be felt at the lower part of the abdomen, generally lying towards one or the other side. The apparent size of this organ will depend upon the degree to which it has contracted, and therefore greatly upon the time at which the examination is made. Dr. Montgomery has pointed out the existence of a dark line, extending from the pubes to the umbilicus, with a dark areola around the latter, in cases of

recent delivery; but he has found this line to exist independently of pregnancy and delivery,—in one case in a girl aged ten, and in another instance, in a lady, labouring under ovarian tumours.

2. The *organs of generation* will be found externally swollen, contused, or even lacerated, with coagula of blood about them. The outlet is much dilated; the os uteri is considerably open, and its margin completely relaxed.

3. The *presence of the lochia*. This is a discharge, first of a sero-sanguineous liquid, but which afterwards appears as a brown or green-coloured serum. It commences soon after delivery, and continues from a week to a fortnight, or even longer. The lochial discharge has so peculiar an *odour*, that some have regarded this alone as furnishing very strong evidence of recent delivery.

The signs which have been here enumerated are found only when no delay has taken place in making the examination, and the woman has been *recently* delivered. In some strong and vigorous females, the body resumes its natural state within a few days, and the traces of parturition may have either wholly disappeared, or have become so ambiguous as to furnish no satisfactory evidence. In others, again, evidence of delivery will be obtainable for a fortnight or three weeks afterwards. In most cases, however, it is difficult, if not impossible, to say, after the lapse of *eight or ten days*, that delivery has certainly taken place, the signs having commonly by that time disappeared. In all cases, the earlier the period at which the examination is made, the more satisfactory will be the evidence obtained. Dr. Montgomery once examined a female *five days* after delivery at the full time, and he was particularly struck with the degree to which the parts had become restored to their natural condition, especially the os and cervix uteri, which hardly differed from their natural unimpregnated form. (Cyc. Pr. Med., loc. cit.)

Signs of delivery at a remote period.—A question may arise, whether it be in the power of a medical practitioner to determine the period at which the delivery took place, *i. e.*, how long a time has elapsed. This becomes necessary where, in cases of concealed birth, abortion, or infanticide (some time after suspected parturition,) a child is found, and it is required to determine, whether the time which has elapsed since the birth of the child, either dead or living, correspond with the supposed delivery of a suspected female. An opinion may be given, within eight or ten days after delivery, from the state of the breasts, of the lochia and of the os uteri; but it becomes difficult after the sixth day; and where the tenth or twelfth day has passed, it becomes still more difficult. After two or three months, it may be regarded as impossible to assign the period of delivery with any degree of precision. (See Devergie, Méd. Lég. i. 446.)

Again in a case of pretended delivery, contested legitimacy, or disputed chastity (*Frazer* v. *Bagley*, see post, DEFLORATION,) the medical jurist may be required to say, whether a female has, at any antecedent period of her life, been delivered. This question, it must be remarked, can be raised only in respect to delivery at the full period, since there is no doubt that abortion in the early stage of pregnancy may take place, and leave no traces of such an event discoverable in after life. Indeed, a few days or weeks are sometimes sufficient to obliterate all evidence of the fact. With respect to delivery at the full term, certain signs have been mentioned, which by some are considered indelible. These are the shining streaks on the skin of the abdomen, a brown mark reaching from the umbilicus to the pubes, and the state of the os uteri, which is said never to close so effectually as in the virgin. In regard to the appearance of the skin of the abdomen, it may be remarked, that any morbid causes giving rise to the distention of the cavity,—as ovarian enlargement, or ascites,—will produce the same effect;—so, also, to a certain extent, will extreme emaciation from a state of obesity. Then, again, these marks on the skin are not always persistent throughout life. Besides, a woman may be, according to the statements of good observers, not only once, but repeatedly delivered, without having these marks produced.

With regard to the state of the os uteri, it is liable to vary in different females, and to be affected by disease,—so that a certain judgment cannot always be formed from its condition. In a female who has not borne children, the mouth of the uterus is in the form of a slit, the angles being bent down, and giving to it the appearance of the os tincæ. Mr. Whitehead has observed, that in a woman who has borne children, the mouth becomes elongated, and loses the slight bend at each of its extremities; the labia are thickened, and more nearly of equal size; the commissures are less clearly defined, and the whole cervix is enlarged, and not so compact in texture. (On Abortion, p. 195.) It must be remembered, however, that the condition of the os uteri, even in the virgin, varies at each menstrual period. Should there be occlusion of the vagina, or the hymen be found imperforate, this will at once negative a previous delivery; but the latter condition will not negative a previous pregnancy, since a woman may have been impregnated and have had an abortion in the early stage of pregnancy, without the necessary destruction of the hymen. This sort of negative evidence will sometimes be of great value. There is a total want of good affirmative evidence of delivery at a remote period, in the living; so that even a conjectural opinion should be expressed only with caution. It is extremely rare, however, that any decision on this subject is required in medical jurisprudence. It might be demanded, in a question of infanticide, where a woman was accused of having destroyed her alleged offspring some months or years before; or in cases of contested legitimacy, where a female is accused of having substituted a child of which she pretends she has been delivered at some remote period of time.

Feigned delivery.—Delivery has often been feigned by females, for the purpose of extorting charity, compelling marriage, or disinheriting parties who have claims to an estate, and in other cases without any assignable motive. Of course, an imposition of this kind could not be sustained before a medical practitioner; and detection is rendered easy, because it is *recent*, and not *remote* delivery which is assumed. The latter would, if pretended, be generally cleared up by an examination, as well as by circumstantial evidence. (See case, Med. Gaz. xix. 231; also another by Capuron, Méd. Lég. des Accouchemens, 110.)

Can a female be delivered unconsciously?—Another important question, relative to delivery in the living female, is whether a woman can be delivered without being *conscious* of it. The signs of delivery may be discovered by the practitioner; the offspring may also be found. The female may admit the fact of her delivery, but allege that she was totally unconscious of it. The only medico-legal case, in which this plea is occasionally raised, is in infanticide; and as the possibility of the occurrence may be questioned, the practitioner must be provided with a knowledge of those facts which medico-legal writers have accumulated respecting it. There is no doubt that a female may be delivered unconsciously, if she be labouring under coma, apoplexy, asphyxia, or syncope; or if labouring under the effects of narcotic poisons, the vapours of chloroform and ether, or intoxicating liquors. It is said, also, that delivery has taken place spontaneously, while a female was in the act of dying. This, however, has no bearing on the present question. It is in those cases where a female, after her recovery, pleads unconsciousness of delivery, that medical practitioners are chiefly consulted. Besides the cases enumerated, hysteria, when accompanied by loss of sense and motion, has been mentioned as a state in which parturition is liable to occur unconsciously. We need not be surprised at delivery taking place under these circumstances, when we consider that the contractile power of the uterus is altogether independent of volition; but it is difficult to believe, unless the morbid states already mentioned are accompanied by the most profound lethargy and entire loss of sensation, that the contractions of this organ, in its efforts to expel the child, should not suffice at once to rouse the individual into consciousness. We ought particularly to expect this in primiparous females; *i. e.* in those who have never borne children. At the same time it must be remembered, that par-

turition with some females especially where the pelvis is wide and the child small, takes place with such rapidity and ease, as scarcely to be accompanied by pain.

It has been observed, that when a woman has frequently borne children, delivery sometimes takes place without effort, and without any consciousness on her part. On other occasions, the female may lie in a kind of torpor or stupor, and have no recollection of her delivery. Mr. King has described the case of a woman, aged thirty-six, the mother of nine children. She received his assistance in her tenth labour: when summoned, she was lying calmly and placidly in bed, and was perfectly insensible. He found that the child had been expelled with the placenta. The woman did not recover her sensibility for ten or twelve hours, and then stated that she had no recollection of the birth of the child, or of any circumstances connected with that event. She suffered no pain or uneasiness. Another case is mentioned by this gentleman, in which sensation appeared to be entirely paralyzed during labour. (Med. Times, May 15, 1847, 234.) It is beyond doubt, that profound lethargy occasionally makes its appearance about the time of delivery. Dr. Schulze met with a case in which the female remained in a state of sleep for three days, and was delivered while in this unconscious condition: on awaking she had no recollection of having suffered any pain during delivery. (Ann. d'Hyg. 1845, i. 216; Med. Gaz. xxxvi. 40.)

The results obtained by the use of the vapours of chloroform and ether, show that the expulsive efforts of the uterus are as energetic in the unconscious, as in the conscious state. It may appear extraordinary, however, that a primiparous female, unless rendered unconscious by narcotic substances, should be delivered without suffering pain: nevertheless, a case of this kind is recorded by Dr. Wharrie. The woman's age was twenty-one: she had been in labour about six hours: she complained of no pain, and the child was born without effort or consciousness. The child was healthy but small, weighing rather more than four pounds (Cormack's Journal, Jan. 1846, 12.) Notwithstanding this case, it is in the highest degree improbable that any primiparous female should be delivered, during *ordinary sleep*, without being roused and brought to a sense of her condition.

Dr. Montgomery relates the case of a lady, the mother of several children, who, on one occasion, was unconsciously delivered during sleep. (Cyc. Pr. Med. See also case in B. and F. Med. Rev., No. ix. p. 256.)

There is another condition in which a woman may state that her delivery took place unconsciously; and this, from its being one of the most common species of defence set up by a female charged with child-murder, must here claim our attention. Thus she will allege, that while suffering from pain, she felt a strong desire to pass a stool: that she went to the water-closet for that purpose, and was there delivered without knowing any thing of the occurrence, until it was too late to save the child. This kind of desire is a very constant symptom of the parturient state; and, as it has been elsewhere remarked, it is often difficult in private practice to restrain a woman from yielding to the feeling, when it certainly would be attended with hazard to the child. We must therefore admit, that an accident of this kind is quite within the range of probability; although here, as in every other instance where unconscious delivery is pleaded, the medical witness ought to inform himself of all the particulars which are stated to have attended delivery, before he gives an answer specially applicable to the case. As a general truth, it cannot be denied that delivery may take place, under these circumstances, without the woman being conscious of it: but before we make the admission in regard to any particular instance, we ought to have a full statement of the facts from the female herself. It is thus that we shall avoid the risk of seeing a premature medical opinion set aside by the subsequent production of circumstantial evidence. Besides, it has been very properly observed, that *after* an accident of this kind, a woman cannot be ignorant of her having been delivered.

Females who have raised this plea in cases of child-murder, have often been known to maintain that they were unconscious of their pregnancy; and thus have attempted to excuse themselves for not having prepared the articles necessary for child-birth. It is possible that a female may not be aware of her pregnancy in the earlier stage; but it is scarcely credible that she should remain ignorant of it in the later period of gestation, or up to the time of her delivery. It is at least to be presumed that she must have some reason to *suspect* her condition; and if only a suspicion existed in the mind of a woman who did not contemplate the destruction of her future offspring, there would assuredly be many circumstances forthcoming, which would vindicate her innocence.

Signs of delivery in the dead.—It will now be proper to examine the signs of delivery which are derivable from a post-mortem examination of the body. Occasionally, we may obtain some account of the female during life, by which our labour will be much facilitated: but, on the other hand, every fact may be studiously concealed from us, and then we may be required to prove not only the delivery, but the previous pregnancy. These investigations relative to pregnancy and delivery in the dead body, are almost exclusively confined to cases of criminal abortion, where the contents of the uterus have been expelled at the sacrifice of the life of the woman. Death commonly ensues in these cases within two or three days after delivery; and then satisfactory proofs are obtainable on an examination of the body; but if the female has survived three or four weeks, it will be as difficult to determine delivery in the dead, as in the living subject. This remark applies to delivery at the full period; for if the uterus have expelled its contents in the first months of pregnancy, the traces of this expulsion will have generally disappeared in the course of a few days.

According to Burns, the following may be taken as the chief appearances when the body is examined soon after delivery at the *full* period. The uterus is like a large flattened pouch from nine to twelve inches long, its mouth being wide open. The cavity contains coagula of blood or a sanguineous fluid; and its surface is covered with the remains of a decidua. In the part to which the placenta has been attached, the substance of the organ appears exposed, presenting several large semilunar or valvular openings. This portion of the uterus is of a very dark colour, so as to have given rise to a suspicion that the organ was gangrenous. The vessels are extremely large and numerous. The Fallopian tubes, round ligaments, and ovaria, are so vascular (full of blood) that they have a purple colour. The spot whence the ovum has escaped is more vascular than the rest of the ovarian surface. Obstetric writers differ greatly in their statements respecting the size of the uterus at different periods after parturition; and these differences may be explained, partly by the fact that the uterus contracts more rapidly in some females than in others, and partly, perhaps, by the circumstance of the birth having been, in some instances, premature. According to Dr. Montgomery, after delivery at the full period, and under perfect contraction of the uterus, if the body be examined within a day or two, it will be found seven inches long and four broad. Its parietes on making a section will be from an inch to an inch and a half in thickness, and will present the orifices of a great number of large vessels. At the end of a week the organ is between five and six inches, and at the end of a fortnight about five inches in length:—the density of the parietes has during this period increased, but their thickness or substance has considerably diminished. The inner surface is still bloody, and covered partially with a pulpy substance resembling the decidua. The orbicular direction of the fibres around the internal orifices of the tubes, is at this time very distinct. In about a month the uterus will have become fully contracted; but the os uteri rarely, if ever, closes so completely as in the virgin state. In a case examined by Dr. Barnes, where a primiparous female, aged 36, died from puerperal fever on the *sixth day* after delivery, the following appearances were met with in the uterus. The internal surface was blackened and congested, especially

in those parts to which the placenta had been attached. There was the appearance of suppurative action in this part. The substance of the uterus appeared healthy: there was no pus in the sinuses. The os uteri showed considerable ecchymosis. The vagina was healthy; the iliac veins contained nothing but loosely coagulated blood. There was in the left ovary a small, well marked corpus luteum, having a central cavity. (Med. Gaz. xli. 294.)

From this statement of the appearances, it will be seen that there must be considerable difficulty in determining the period prior to death at which parturition took place. The difficulty is increased when the female has been prematurely delivered, or if death has not taken place until some time after delivery. Our opinion may be then in some degree strengthened by searching for those signs which have been described as characteristic of parturition in the living. These, if present, will always furnish strong corroborative evidence, not only of the fact of delivery, but of the period at which it had probably occurred.

Evidence afforded by the presence of corpora lutea.—The condition of the *ovaries* has been considered to furnish very strong evidence in the dead body, not so much of delivery as of previous pregnancy. These organs, as it has been already stated, when examined soon after delivery, are found of a deep purple colour, owing to their extreme vascularity. If the female has really been pregnant, we may expect to find on one or the other of these bodies, the appearance which is denominated a *corpus luteum*. The accounts given by obstetric writers of the characters of corpora lutea, and the evidence which they are capable of furnishing in legal medicine, are very conflicting. Dr. Montgomery states, that in the true corpus luteum the ovary presents a protuberance with a distinct cicatrix on some part whence the ovum has escaped. The protuberant part will be found on section to have an oval form, and to be of a dull yellow colour. It is very vascular, and in texture resembles the section of a kidney. In the centre of this section there will be either a cavity or a radiated white cicatrix, according to the period at which the examination is made. The cavity remains for about three or four months after conception, and is surrounded by a strong white cyst:—as gestation advances, the opposite sides approximate, and a radiated white cicatrix results. The size and vascularity of the corpus luteum are considerably diminished by the time gestation is completed; and in about five or six months afterwards, *i. e.* fourteen months after its first formation, it disappears altogether from the ovary, so that the corpus luteum of one conception is never to be found with that of another, unless a premature expulsion of the contents of the uterus has taken place. (Cyc. Pr. Med., Pregnancy, 496; see also Edinb. Monthly Journal, Jan., 1845, p. 58.) The presence of a corpus luteum, as it is here described, does not prove that a woman has borne a child. In the opinion of some obstetric authorities, it establishes that conception has taken place; but the embryo may have been converted into a mole or a blighted fœtus, and expelled at an early period. It was formerly supposed that one true corpus luteum only was met with in pregnancy with one child; but among other facts which show that such an inference is erroneous, is a singular case reported by Dr. Renaud to the Manchester Pathological Society. He examined the body of a female who died in the seventh month of her pregnancy, and from whose uterus he extracted a fœtus. There were no traces of a blighted ovum. The ovary, however, presented *two* distinct and well marked corpora lutea. (Med. Gaz. xxxix. 599.) Had the ovary alone been examined, it might have been supposed that this female had had twins.

The characters of what has been hitherto denominated the false corpus luteum have been thus described:—1. There is no prominence or enlargement of the ovary generally, at the part where it is situated. 2. The external cicatrix is wanting. 3. There are often several in both ovaries. 4. The texture is not glandular, nor can it be injected. 5. When laid open by section, it has neither a central cavity, nor the cicatrix which results from its closure. Dr. Patterson

has published some remarks on this subject, with medico-legal cases and plates. (Ed. Med. and Sur. Jour. liii. p. 49.) According to this gentleman, the *false* may be distinguished from the *true* corpora lutea by the following signs. They have in general an irregular form, and want either the central cavity lined with a distinct membrane or the puckered cicatrix. They have no concentric radii, and are frequently numerous in both ovaries. He relates the following case in order to show that the presence or absence of a *true* corpus luteum may be sometimes important in a question of disputed identity in the dead. Four medical students were charged with having disinterred the body of a lady; but the body was disfigured that the deceased could not be identified by her relatives. In one of the ovaries a true corpus luteum was reported to have been found; a circumstance which, if true, proved that it could not be the body of that lady, since she was a virgin, and advanced in life. On the trial the medical evidence was very conflicting; one half of the witnesses maintained that the body which was found in the ovary was a true corpus luteum, while the others contended that it was not.

Since the first appearance of this work, there have been many contributions to our knowledge on this subject. In opposition to the views of Dr. Montgomery and Dr. Patterson, Dr. Knox, an experienced anatomist, asserts that there is no distinctive character whereby what has been called the *true*, can be known from the *false* corpus luteum, the only difference being that the latter is smaller. What have been called corpora lutea may be formed in virgin animals, independently of intercourse; and the time of their disappearance from the ovary varies from three months to an almost indefinite period. (Med. Gaz., Dec. 31, 1843.) That there is considerable difficulty in distinguishing the true from the false corpora lutea, is proved by reference to a case reported in the Medical Gazette (xxxiv. 623,) in which two experienced observers differed. Dr. Lee thought that the preparation which was the subject of examination was not a corpus luteum, while Mr. Wharton Jones thought that it was,—founding his decision on a microscopical examination. This difference of opinion shows that a diagnosis is by no means so simple a matter as some writers assert. Mr. W. Jones agrees with Dr. Knox in considering that a corpus luteum may occur in the ovary independently of coitus; and the existence of one in this organ would therefore afford no proof whatever of coitus having taken place. The discovery of the ovum in the uterus, *in process of development*, could alone, in the present state of our knowledge, warrant an affirmative opinion on this point in a court of law; and this I believe to be the safest view of this much-contested question. On the other hand, the absence of a corpus luteum from the ovary would not warrant the opinion that coitus had not taken place.

These views regarding the evidence derivable from the presence of corpora lutea, have received considerable support from the researches of Professor Bischoff. (Med. Gaz. xxxv. 443, et seq.) The experimental investigations of this gentleman appear to show that the extrusion of an ovum, or the production of a corpus luteum, is by no means necessarily connected with coitus:—that the ova undergo a periodical maturation, about the time of menstruation, and escape whether there be coitus or not;—therefore that fecundation is only likely to occur when intercourse is had about this period. This is also the opinion of Raciborski: indeed, some physiologists now regard menstruation as the alternation of conception (see Dub. Quart. Jour., May, 1846, p. 426,) and consider that there is no period so favourable to conception, as that which immediately follows the cessation of the menses. In this respect the Koran appears to conflict with the laws of physiology, since it is laid down by Mahomet that females are impregnable eight days before, and eight days after menstruation. (Rostan, Cours d'Hyg. ii. 438.) It is not a little singular that this comprises the period at which, according to modern theories, conception commonly takes place. Women may conceive during the flow of the menses; it is also well ascertained that a woman who has never menstruated may conceive, and that conception may take place

two days *before* the period of menstruation. Raciborski has met with l instances in illustration of these views. (Advances in Physiology, Baly irkes, p. 59.) In the theory above given, we have an explanation why a lutea, or bodies closely resembling them, are so often found in virgin s, and it would also account for those differences of opinion among ex- ed men, which almost invariably occur when it becomes a debated ques- hether a corpus luteum be true or false. The theory would further ex- ases like the following, reported by Mr. Elkington:—A woman aged forty- ho had not borne a child for *seven years*, died from diseased lungs. On ht ovary were two corpora lutea; and the Fallopian tube on that side was and more vascular than on the other. The deceased expected to men- the day she died, or at least one day later. (Prov. Med. Jour., Feb. 104.) Dr. Ritchie, of Glasgow, has lately examined this subject, and has l at results which tend to confirm the views of Professor Bischoff and Mr. nes. He calls the bodies corpora menstrualia vel periodica. They may, opinion, be formed independently of pregnancy, and may possibly assume characters of what are called corpora lutea, by some reflex excitement in erine organs. According to this gentleman, there are no fewer than eight es, which are liable to have their characters intermixed. (Med. Gaz. xxxvi. 058.) A recent case, in which a well marked corpus luteum was found ling with menstruation in a female who had been executed, is reported by ichel. (Med. Gaz. xliv. 307.)

ery full account of the general and microscopical characters of the true and orpora lutea, by Dr. Renaud, will be found in the Edinburgh Monthly al, August, 1845, p. 589; and an excellent summary of the present state siological knowledge on this subject is given by Drs. Baly and Kirkes. at Advances in Physiology, 1848, p. 46.) These gentlemen conclude from esearches, that cases can seldom occur where the mere presence of a corpus a can be taken as a proof of previous impregnation; and they consider the ing rules to be deducible from the facts which they have collected. 1. A luteum in its early stage (that is, a large vesicle filled with coagulated having a ruptured orifice, and a thin layer of yellow matter within its affords no proof of impregnation having taken place.—2. From the pre- of a corpus luteum, the opening of which is closed, and the cavity reduced iterated, only a stellate cicatrix remaining, also no conclusion as to preg- having existed can be drawn, if the *corpus luteum be of small size*, not ning as much yellow substance as would form a mass the size of a small -3. A similar corpus luteum of larger size than a common pea, would be *presumptive* evidence, not only of impregnation having taken place, but gnancy having existed during several weeks at least; and the evidence approximate more and more to complete proof, in proportion as the size of rpus luteum was greater. (Op. cit. p. 57.)

m this statement, it will be perceived that the difference is only relative bitrary, chiefly depending on the *size;* and, as in pregnancy, corpora lutea nnd of very variable size, while in menstruation they may, under great ex- nt, attain a large size, it is obvious that no safe inference can be drawn heir presence, irrespective of other signs of impregnation. The terms *true lse*, therefore, are inappropriate; and the most serious mistakes may arise eception of evidence on this point. The law requires absolute certainty, ere probability or presumption; and in the present state of physiology, the falls short of what is necessary to guide the verdict of a jury. At a trial tempted abortion, *Reg.* v. *Goodall*, (Nott's Lent Assizes, 1846,) on ex- ng the body of the female on whom the attempt was alleged to have been it was found that she was *not* pregnant; but on inspecting the ovary, a luteum was there discovered. This was described as *false*, apparently e there was no proof of impregnation. Had an embryo been found in the

uterus, or had there been proof of its expulsion, it would probably have been described as *true*. Dr. Meigs very justly says, that corpora lutea may vary in size, but in all cases they are real. Physiologically speaking, they do not admit of a division into true and false. (Females, and their Diseases, 1848, p. 43.)

From these considerations, therefore, it appears to me, we can only come to the conclusion expressed in former editions of this work, that medical evidence respecting the nature of a corpus luteum in an unknown case, if received in a Court of Law at all, should be received with the greatest caution, and only from a witness of great experience. The old doctrine on this subject, that the presence of such a body on the ovary affords *certain* and undeniable evidence of impregnation, may be regarded as completely subverted. [For a most complete and splendidly illustrated monograph on corpora lutea, see Dalton's prize essay, published by the Am. Med. Assoc., 1852.—H.]

Characters of the ovum or embryo to the sixth month.—Hitherto the examination has been confined to the female; but it is now necessary to describe the characters of the ovum or embryo at the early stages of pregnancy, since, when this can be procured, good medical evidence may be derived from an examination of it. If the ovum be expelled within *a month* after conception, it is scarcely possible to detect it, owing to its small size and its being enveloped in coagula of blood. Burns examined three uteri, within the first month, where no expulsion had taken place, but even under these favourable circumstances he failed in discovering the ovum. At first the ovum contains no visible embryo; but it appears merely to consist of vesicular membranous coverings. According to this writer, when first distinctly seen through its membranes, it is of an oblong form and about a line (the twelfth of an inch) in length. At the *sixth week*, it is slightly curved, resembling, as it floats, a split pea. In the *seventh week*, it is equal in size to a small bee; and by the end of the *second month*, it is bent, and as long as a kidney bean. After this, development goes on rapidly: the features are in part well marked, and the extremities are gradually formed. At the *third month*, the fœtus weighs from one to two ounces:—when stretched out it measures about three inches, and the genital organs, although the sex is not distinguishable, are large in proportion to the rest of the body. The membranes are larger than a goose's egg. At the *fourth month* the fœtus is from five to six inches long, and weighs from two to three ounces; at the *fifth month* it measures from six to seven inches, and weighs from five to seven ounces; at the *sixth month*, its length is from eight to ten inches, and its weight about a pound. (For the characters of the child beyond this period, see ante, p. 284.) The great difficulty will consist in determining the nature of the supposed ovum or embryo between the second and third month. In making the examination, it should be placed in water, and all coagula gently washed away or removed by some blunt instrument. Alcohol may be used as a substitute for water, after the blood has been removed. If the embryo cannot be found, the decidua and chorion may be recognised;—the former, by its forming the outer investment with its smooth internal and rough external or uterine surface; the latter, by the villous appearance of that portion of it which would have become the placenta. Between the third and fourth month, the fœtus may be commonly identified without much difficulty.

Moles.—The substance expelled from the womb may have been what is termed a mole—a morbid production of a fleshy or of a bloody structure, appearing like a blighted ovum or placenta. It has been said that a mole is never formed in the virgin uterus, but that its presence always indicates previous sexual intercourse: this point, however, is far from settled. The term mole is also applied by some to coagula of blood, polypi, or hydatids. In one case reported, a mole and an ovum were expelled together,—a fact which shows that they may coexist. The symptoms accompanying a mole strongly resemble those of pregnancy:—and the appearances produced by its expulsion are not to be distin-

guished from those attending the abortion of a fœtus at an early period of gestation. The only means of diagnosis would be derived from an examination of the expelled matters. The local injury produced by the expulsion of these bodies on the organs of generation, is by no means so great as that caused by delivery at the full period.

Hydatids.—The signs of pregnancy and delivery may be present in a female; and yet these may be owing to the existence of hydatids in the womb. It was formerly a question, whether conception or previous impregnation was or was not necessary to their formation. Dr. Koch, of Heiligenbeil, has reported a case where they were probably produced independently of sexual intercourse. A healthy strong woman, 32 years of age, had been married nine years, and had borne four children without difficulty. At this time she was living apart from her husband, so that according to the declaration of both there could have been no intercourse. The menstrual function ceased after the weaning of the last child, and the patient observed that her abdomen became enlarged as if she were again pregnant. After three months' suffering, during which she was continually upbraided by her husband in consequence of her condition, pains came on, and a hydatid mole (a cyst of hydatids) about the size of two fists was extruded. The hydatids were collected in a grape-like cluster, and the cysts varied in size from a hemp-seed to that of a walnut. (Wildberg, Jahrbuch der gesammten S. A., 1837, 1 Heft, 145.) In a case communicated by Mr. Hunter to the Lancet, hydatids co-existed with pregnancy, and the mass came away on the birth of the child. (April 18, 1846, 430.) When the mass is expelled, it is found to consist of a group of vesicles or cysts of various sizes: but sometimes, when this disease follows intercourse, the cysts are found mixed with the remains of a blighted ovum or a coagulum of blood. Unless the expelled matters be produced, it would be very difficult to say, from an examination during life or after death, whether the uterus had contained an embryo or hydatids. These morbid growths may even be enclosed in an investing membrane similar to the decidua, and there may be the remains of a corpus luteum in the ovary; but it is not likely, when carefully examined in water, that they can be mistaken for an ovum or embryo. An interesting case of the conversion of an ovum into hydatids will be found in the Med. Gaz. xlvi. 454.

In examining the bodies of those who have died while labouring under uterine hydatids, it has been found that occasionally the whole of a blighted ovum is converted into them; but sometimes only a part is thus converted. The cysts vary in number: there may be only one large cyst, and it is said this condition is more frequently met with when hydatids are combined with pregnancy or with a mole, than when alone. The hydatid cysts appear to be connected with the inner surface of the uterus, by the unchanged portion of the ovum or placenta; and thus, upon their removal, we might expect to find the uterine surface more or less similar to that of the gravid state, according to the degree of change which may have taken place in the ovum. Burns observes, that the relative magnitude of the vessels in the two states has not been ascertained; few opportunities being afforded of examining the state of the organ in this disease. According to Madame Boivin, the hydatids are sometimes surrounded by an investing membrane similar to the decidua. In a case which occurred to Mr. Brown, the symptoms caused by uterine hydatids were mistaken by the female (a married woman who had had children) for those of true pregnancy. The catamenia had ceased for about four months, the breasts were enlarged—there was a darting pain through them, with soreness of the nipples, and morning sickness. In about a month flooding took place, and the hydatids came away. (Obstetric Record, i. 21.) These facts may have an important bearing on medico-legal practice, and in this respect, the following case, reported by Dr. Chowne to the Westminster Medical Society, Nov., 1843, will be found of interest:—A woman was seized with pains, resembling those of labour, and a mass of uterine hydatids was expelled, which

were supposed to have been in the uterus about five months. When the woman was examined, thirty-six hours afterwards, there were all the signs of recent delivery about her. The parts of generation presented the usual appearances met with on the expulsion of a fœtus: the breasts were enlarged, the areolæ elevated, of a brown colour, the follicles prominent, and the organs evidently contained milk. The occurrence of this case led Dr. Chowne to think that had the body of an infant been found murdered and concealed in the house where this woman lived, it would probably have been pronounced to be her child. A medical man might have strengthened the suspicion of criminality by declaring that there were all the signs of delivery about her. It may be observed, however, that in such a case, the woman would probably state that no child, but some tumour, had come away from her; and a medical man would not be justified in swearing, that the appearances of delivery absolutely indicated, under all circumstances, that the woman must have been delivered of a *child*. On the contrary, it is a well known medical fact, that similar appearances might arise from the expulsion of a mole or hydatids. Circumstantial evidence would be against her, only on the assumption that some person had wilfully concealed or made away with the substantial proof of her innocence, *i. e.* the group of hydatids which had been expelled. Mr. Pearson has more recently communicated to the Medical Times (Dec. 30, 1848,) a case in which, after the expulsion of a mass of hydatids, there were all the appearances which are usually observed after delivery.

Some of the questions which have been here considered, were raised on the trial of *Angus*, for the murder of *Miss Burns*, at the Lancaster Assizes, 1808. It was alleged that the deceased was pregnant,—that the prisoner had administered corrosive sublimate to her for the purpose of inducing abortion, and that this had caused her death. A question was raised at the trial relative to the appearances presented by the uterus as indicative of recent delivery. On examining this organ, it was found to be considerably enlarged, and on its inner surface was a mark, about four inches in diameter, plainly discernible, to which the placenta had been apparently attached. The os uteri was much dilated. Indeed, the appearances were described to be such as might have been expected to be found two hours after the birth of a full-grown child. The evidence respecting previous pregnancy was conflicting; and the prisoner was acquitted, because the death of the deceased could not be distinctly traced to any criminal act on his part. The ovaries were not examined until after the trial, when a body which was considered to be a true *corpus luteum* was found on one of them; and some eminent authorities agreed that it indicated an advanced state of pregnancy. (See Paris and Fonblanque, Med. Jur. ii. 179.) One medical witness appeared for the prisoner; and he contended that the state of the uterus did not justify the medical inference that there had been recent delivery. He assumed that the appearances might have been due to the expulsion of a group of hydatids. On the whole, the medical defence, so to term it, appears to have been more ingenious than sound; and to have rested upon assumptions, which, if generally admitted, would effectually do away with all medical evidence in cases of criminal abortion. The contents of the uterus were not produced,—a fact which left the case in mystery.

CONCEALMENT OF BIRTH.

CHAPTER XLIX.

MEDICAL EVIDENCE REQUIRED IN REFERENCE TO DELIVERY—CONCEALMENT OF THE BIRTH OF A CHILD—DEFINITION OF THE CRIME—FEMALES ACQUITTED OF INFANTICIDE FOUND GUILTY OF CONCEALMENT—MEDICAL EVIDENCE FROM THE REMAINS OF THE BODY—ANALYSIS OF BONES—THE CHILD MUST BE DEAD—CONCEALMENT OF THE OVUM OR EMBRYO—NOT NECESSARY TO PROVE WHEN THE CHILD DIED.

Concealment of birth.—Medical evidence respecting delivery is required in two cases: 1, where the birth of the child is wilfully concealed; and 2, where the contents of the uterus have been prematurely expelled by criminal means. The concealment of pregnancy is no offence in the English law; but the concealment of *delivery* or *of the birth* of a child, is a misdemeanor by the 9th Geo. IV. c. xxxi. sec. 14, the words of which are to the following effect:—

"Be it enacted, that if any woman shall be delivered of a child, and shall, by secret burying, or otherwise disposing of the *dead body* of the said child, endeavour to conceal the birth thereof, every such offender shall be guilty of a misdemeanor; and being convicted thereof, shall be liable to be imprisoned with or without hard labour in the common gaol or house of correction for any term not exceeding two years; and it shall not be necessary to prove, whether the child died before, at, or after its birth."

This is the offence of which those females who are charged with infanticide are most commonly convicted, while the Scotch law punishes females for the concealment of pregnancy. (Alison's Criminal Law, 153.) The medical evidence on trials for this offence is exclusively derived from an examination of the mother; and thus, much will depend upon the time at which this is made. With respect to the child, its body need not even be produced, provided there be satisfactory evidence of its death. In the case of The *Queen* v. *Varney*, (Oxford Lent Assizes, 1837,) it was proved that the prisoner had been pregnant, and subsequently delivered of a child. Its body had been burnt, and only a few remains of the bones of a human fœtus were found in the ashes of a grate. The prisoner was convicted of the offence. In a case like this, where an attempt has been made to destroy the body of a child by burning, it will, of course, be necessary to have good evidence that the bones are those of a *human fœtus* or child. They may retain their shape whether burnt in a close fire or in the open air: in the latter case alone they will be white. A small fragment only of either end of any well marked bone, will suffice for identification. If burnt to a complete ash or powder, it will then be difficult to identify them. Orfila was consulted in a case of this kind, where a woman had burnt her child in an oven, and its ashes had become mixed with those of wood. He suggested, that on calcining the residue with potash, the ashes of a human fœtus might be known by their yielding cyanide of potassium, owing to the nitrogen which would remain in and about them. The ashes of wood do not yield the cyanide under similar circum-

stances. (Ann. d'Hyg. 1845, ii. 129.) The conclusions at which Orfila has arrived might, it appears to me, lead to a serious error;—the presence of a flannel dress, of an old hat, shoe, or any nitrogenous substance, would, on incineration, give rise to precisely similar results. When the *form* of a bone cannot be recognised, all that medical evidence can, as it appears to me, accomplish, is this:—The detection of a large quantity of *phosphate of lime* in the ash, would indicate that bones were present, and thus distinguish the ash of bone from the ashes of other substances. Still the bones might have belonged to an animal, and not to a human fœtus. There are no means of distinguishing the ash of human, from that of animal bone.

According to the statute the child must be *dead*—the concealment of the birth of a living child not being any offence, unless it should happen to die before its birth was made known. In the case of The *Queen* v. *Woodman*, (Kingston Lent Ass. 1845,) the woman was acquitted because the child was living when concealed. Mr. Chitty says, that to constitute the offence, the child must have advanced to the end of the seventh month (Med. Jur. 412;) but it is to be presumed that the concealment of the birth of a dead child at the sixth or under the seventh month, would be as much an infringement of the statute as if it were more advanced. The concealment of the aborted but undeveloped ovum—a monster, *i. e.* of a child without human shape, a mole or other morbid growth, would not probably be considered a contravention of the statute. Mr. Lane communicated to the Medical Times (Aug., 1845) a case in which a charge of concealed birth was dismissed by the magistrates of Surrey, because the concealment referred to a child born at the eighth month *in its membranes*. The woman stated that she did not consider it to be a child! If this view be correct, the main object of the statute (*i. e.* to prevent secret delivery, so often leading to murder) may be effectually evaded. The case being entirely new, should have been sent to trial, and the decision left to the proper interpreters of the law. A magisterial decision can furnish no precedent on a question of this kind.

It will be perceived, that it is not material here, as it is in a case of alleged infanticide, to prove *when* the child died,—whether before, during, or after its birth; and thus those subtleties and technicalities which have been elsewhere pointed out in cases of infanticide, are avoided. In regard to proof of concealment and what constitutes it, these are essentially legal points:—but a medical practitioner may sometimes benefit an accused party, if he can prove that the female had made application to him on the subject of her pregnancy and delivery. The law is especially lenient under such circumstances. Questions connected with concealment of birth do not fall under the jurisdiction of a coroner:—the medical evidence is therefore required by a magistrate. Medical witnesses were, until lately, exposed to much trouble and inconvenience in giving their evidence on these occasions (see Med. Gaz. xix. p. 287;) but the defect has been remedied by a recent statute. (1 Vic. c. xliv.) [Concealment of the birth and death of a bastard child is a penal offence at common law in the United States; and special statutes, in most of the states, have rendered it a grave misdemeanor, punishable with fines and imprisonment, according to the respective enactments. —H.]

CRIMINAL ABORTION.

CHAPTER L.

GENERAL REMARKS ON THE CRIME OF ABORTION—ABORTION FROM NATURAL CAUSES—ITS FREQUENCY. CRIMINAL CAUSES—LOCAL VIOLENCE—ABORTION BY MECHANICAL MEANS—FROM VENESECTION—MEDICINAL SUBSTANCES—POPULAR ABORTIVES—SIGNS OF ABORTION IN THE FEMALE—SPECIFIC ABORTIVES—ABORTION NOT A RESULT OF POISONING—LOCAL APPLICATIONS. FEIGNED ABORTION—LEGAL RELATIONS—MEANING OF THE WORD NOXIOUS AS APPLIED TO DRUGS—ON INDUCING PREMATURE LABOUR—MEDICAL RESPONSIBILITY—PROOF OF PREGNANCY NOT NECESSARY—ABORTION OF MONSTERS—EXTRA-UTERINE CONCEPTIONS—ABORTION OF MOLES AND HYDATIDS.

General remarks.—By abortion is commonly understood, in medicine, the expulsion of the contents of the uterus *before the sixth month of gestation.* If the expulsion take place between the sixth and ninth month, the woman is said to have a premature labour. The law makes no distinction of this kind, but the term abortion is applied to the expulsion of the fœtus at *any period of pregnancy*, and in this sense it is synonymous with the popular term *miscarriage.* Criminal abortion is rarely attempted before the third month:—it is perhaps most common between the fourth and fifth month, because then a female begins for the first time to acquire a certainty of her pregnancy. The causes of abortion may be either *natural* or *violent.* The latter only fall under the cognizance of the law;—but a medical witness should be well acquainted with the causes which are called natural, in contradistinction to others which depend on the application of violence. These *natural* causes are so frequent, that according to Mr. Whitehead's observation,—of 2000 pregnancies, one in seven terminated in abortion. These causes are commonly ascribable to peculiarities in the female system,—to the presence of uterine or other diseases, or to some moral shock sustained by the woman during pregnancy. Any diseases which strongly affect the uterus or general system of the female, may give rise to abortion. An attack of small-pox has been known to produce it; and it has been suggested by Mr. Acton, that the presence of constitutional syphilis in the father is not only a cause of infection in the offspring, but of repeated abortion in the female. (Med. Gaz. xxxvi. p. 164.) These facts deserve attention, when it is proved that a woman has really aborted, and an attempt is unjustly made to fix an alleged act of criminality on another. For further information on the numerous natural and accidental causes which may give rise to abortion, the reader may consult the work of Mr. Whitehead (On Abortion and Sterility, p. 252.) In considering the operation of these causes, it is proper to bear in mind that during pregnancy the uterus is subject to a natural periodical excitement, corresponding to what would have been the menstrual periods dating from the last cessation. Hence comparatively trivial causes operating at these periods, may lead to an expulsion of the fœtus.

The *violent* causes of abortion may be of an accidental or criminal nature. In general, the distinction will not be difficult:—the kind of violence and the

adequacy of the alleged cause to produce abortion, will commonly clear up the case.

Criminal causes. Local violence.—These causes are either mechanical or they depend on the use of irritating medicinal substances. They operate with greater certainty in proportion to the advanced state of the pregnancy. Among the *mechanical causes*, may be mentioned undue exercise, the violent agitation of the body, as by riding or driving over a rough pavement, in which cases no marks of violence would be apparent. Any physical shock, sustained by the body, may operate indirectly on the uterus. Blows or violent pressure on the abdomen are sometimes resorted to; but in these cases the marks of violence must be perceptible. Instruments have been devised for the purpose of piercing the membranes, destroying the child, and thereby leading to its expulsion. Dewees speaks of such instruments being well known in England, and of English midwives deriving a living from the practice of this crime, a statement which it would hardly be said is founded in error (i. 285.) Although mechanical means are more effectual in producing abortion, than medicinal substances, yet from the fact of such attempts being made by ignorant persons, the woman generally dies from hysteritis, peritonitis, or other serious after consequences. A case was tried in the North of England some years since, in which the evidence showed that the prisoner had attempted to produce abortion in the deceased, by thrusting wooden skewers into the substance of the uterus. Inflammation and gangrene took place, and the woman died. The prisoner was convicted and executed for murder. (For a similar case by Mr. M'Pherson, see Med. Gaz. xxxvi. 81. See also a case in the same journal, vol. xlv. page 693.) This kind of injury to the uterus always implies the interference of some other person in the perpetration of the crime. These *mechanical means* can seldom be applied to the uterus, without leaving marks of violence on that organ, as well as on the body of the child. If the mother die, a result which generally takes place, an inspection will at once settle the point. (Ann. d'Hyg. 1834, 191; 1838, i. 439; 1839, ii. 109.) If the mother survive and the child be expelled, then marks of violence will be found on its body. These marks may not be sufficient to account for its death; but this is not here the question. If it can be proved that they have not resulted from accidental causes subsequently to delivery, then their presence will furnish strong corroborative evidence of the actual means by which abortion was attempted. It is said that abortion has been in some instances accomplished by frequent venesection. This effect may follow from the violent shock produced by the loss of a large quantity of blood. An examination of the veins of the arms would show whether any such attempt had been made.

Medicinal substances. These are perhaps more frequently resorted to for inducing criminal abortion than other means; but they rarely answer the intended purpose, and when this result is obtained, it is generally at the expense of the life of the mother. Mineral poisons have been ignorantly employed for this nefarious object; as arsenic, corrosive sublimate, sulphate of copper, and other irritants. Croton oil, gamboge, aloes (Henke, Zeitschrift, 1844, ii. 302), elaterium, and other drastic purgatives, have also been used for a similar purpose. Purgatives which produce much straining,—powerful emetics or diuretics, will readily excite abortion in the advanced stages of pregnancy; but these violent medicines fail in their effect at the earlier stages. The substances just mentioned exert an indirect action on the uterus by producing a shock to the general system:—but it is said there is a certain class of bodies called emmenagogues, which have a specific action on the uterus itself. Among these, the *Ergot of rye*, or *Secale cornutum*, is particularly mentioned. This substance has been found, in many instances, to bring on violent action of the uterus at an advanced stage of gestation, or when efforts at parturition had already commenced. There is, however, considerable difference of opinion respecting its emmenagogue properties. According to Dr. Lee, it has no effect, at least in the *early* stages of gestation,

although given in very large doses. (Med. Gaz. xxv. 10; see also Ed. Med. and Surg. Jour. liii. 27.) Dr. Kluge, of Berlin, found that its properties varied according to whether it was gathered before or after harvest:—in the former case, it had an energetic action, while in the latter it was powerless. The properties of the secale are not at all known to the vulgar; and this may account for the fact of our rarely hearing of cases where it has been criminally administered to pregnant females. Dr. Beatty states that when used in obstetric practice it is liable, by absorption into the system of the mother, which may take place within two hours, to endanger the life of the child. (Dub. Med. Jour. May, 1844, 202.) This question was actually referred by the French Government to the Academy of Medicine in 1845, as there was reason to think that under its employment children were frequently born dead. (Ann. d'Hyg. 1846, i. 204. See also Med. Gaz. xlvi., p. 680.) In confirmation of Dr. Beatty's statement, Drs. M'Clintock and Hardy report, that out of thirty cases in which it was administered, twenty children were born dead. (Practical Observations, 95.)

Among substances which have acquired popular repute as abortives, are savin, rue, iron-filings, squills, black hellebore, and cantharides. None of them have any influence on the uterus, except in affecting it indirectly by their irritant action on the system. (For an account of the poisonous properties of savin, see ante, p. 124.) In the coroner's return for 1837-8, there were four cases of the administration of savin and other drugs with the view of procuring abortion. In three of these cases, the mother died undelivered; in the fourth, the child perished.

Specific abortives. Ergot.—On trials for criminal abortion perpetrated or attempted, a medical witness must be prepared for a close examination on the specific emmenagogue properties of the drug administered. A very instructive case which occurred a few years since (*Reg.* v. *Calder*, Exeter Lent Assizes, 1844,) has been ably reported, with comments, by Dr. Shapter (Prov. Med. Journal, April 10, 1844.) It was alleged in this case, that savin, cantharides, and ergot, had been respectively given by the prisoner, a medical man, for the purpose of procuring miscarriage. The prosecutrix was a woman of notoriously bad character, and the prisoner was acquitted. There were three medical witnesses, who agreed that savin and cantharides were only likely to occasion abortion indirectly, *i. e.* by powerfully affecting the system—the view commonly entertained by professional men. Some difference of opinion existed with regard to *Ergot.* Dr. Shapter stated in his evidence, that he did not think the ergot would act unless the natural action of the uterus had commenced,—a statement supported by a number of authorities. Subsequently to the trial, he collected the observations of many obstetric writers, and so far modified his opinion as to admit that the ergot might *occasionally* exert a specific action on the uterus, in cases of advanced pregnancy, where uterine action had not already commenced. His summary on this subject is one of the best which has been published. Dr. Ramsbotham has reported three cases, from which it would appear that the ergot may in some instances exert a direct action on the impregnated uterus. In these instances, the females were in or about the *eighth* month of pregnancy. (Med. Gaz. xiv. 434.) Dr. J. H. Davis also believes that it is a specific excitant of uterine action, and points out the cases in which, in his opinion, it may be safely employed. (Lancet, Oct. 11, 1845, 393.) Mr. Whitehead, who has had considerable experience on this subject, has found that its action is very uncertain. In a case under his care, where, in a woman with deformed pelvis, it was considered advisable to procure abortion in the fifth month of pregnacy, the ergot alone was employed, and at first with the desired effect. It was given in three successive pregnancies; and in each instance labour-pains came on after eight or ten doses had been administered, and expulsion was effected by the end of the third day. It was perseveringly tried in a fourth pregnancy in the same indivi-

dual, and failed completely. (On Abortion, 254.) It also failed in a recent case in the hands of Dr. Oldham. (Med. Gaz. vol. xliv., p. 49.) Nevertheless, the balance of evidence is now decidedly in favour of its specific action; and, according to Dr. Griffiths, this is so well known to the inhabitants of the United States, that it is in very frequent use as a popular abortive. Perhaps the differences which have been observed in its action may depend on the period at which it has been administered to a pregnant woman. Admitting that the uterus is subject to periodical excitement, corresponding to the menstrual periods, it is probable that the action of the ergot may be more powerfully abortive at these than at other times. The reader will find a large collection of cases, illustrating the properties of this drug, in Wibmer, (Arzneimittel und Gifte, ii. 80. *Sphacelia Segetum.*) Ergot has been supposed to exert a prejudicial action on fœtal life, even when given with innocent intention. For some remarks on this subject by M. Danyau, see Med. Gaz. xlvi. p. 680.

Savin. Oil of Savin.—There appears to be less doubt about the action of savin. In a case which I was required to investigate in 1845, various questions were put as to whether this substance, which had been taken in the state of powdered leaves, and had caused the death of a woman, exerted any specific action on the uterus to induce labour. The reply was given, that, in large doses, it acted only indirectly as an abortive by its irritant properties. (See Med. Gaz. xxxvi. p. 646.) It is proper to remember, that the infusion is more powerful than the decoction; since the poison, being a volatile oil, is dissipated by long boiling. Savin is, however, most commonly taken or administered in the form of powder. In a case tried at the Cornwall Lent Assizes, 1852 (*Reg.* v. *Pascoe*,) the accused, a medical man, was convicted and sentenced to transportation for administering *oil of savin* to a female with intent to procure miscarriage. The proof of intent rested partly on medical and partly on moral circumstances. It appeared that the prisoner had given fourteen drops of the oil, in three doses, daily—a quantity which, according to the medical evidence at the trial, was greater than should have been prescribed for any lawful purpose. The medicinal dose, as an emmenagogue, on the authority of Christison, is from two to five *minims*, and, according to Pereira, from two to six *drops*. The quantity given by the prisoner, although a full dose, was not, therefore, greater than these authorities recommend; and his criminality appears to me to have rested not so much on the dose given, as on the question whether he knew, or as a medical man had reason to *suspect*, that the female for whom he prescribed it was pregnant. No medical authority would recommend oil of savin in full doses for *pregnant* females; and with regard to the existence or non-existence of pregnancy in a special case, medical men are reasonably presumed to have better means of satisfying themselves than non-professional persons. The prisoner's innocence, therefore, rested on the presumption that he implicitly believed what a young woman told him regarding her condition,—that he had no reason to *suspect* her pregnancy, and therefore did not hesitate to select and prescribe a medicine which is very rarely used by practitioners, and certainly has an evil reputation. If the prosecutrix is to be believed, she told the prisoner that she had disease of the heart and liver, and that nothing more was the matter with her. It is absurd to suppose that oil of savin should be prescribed for such a disease as this. The prisoner, on the hypothesis of innocence, must have intended the medicine to act on the uterus, and must have inferred the existence of an obstruction of menstruation from natural causes irrespective of pregnancy. The jury do not appear to have given him credit for such ignorance of his profession, and this probably led to his conviction. At the same time it is impossible to subscribe to the unqualified statement of one of the medical witnesses for the prosecution,—that no person of competent knowledge would prescribe oil of savin in such quantities except for abortion. Every competent man would undoubtedly satisfy himself that a young female, whose menses were obstructed, was *not pregnant*, before he prescribed full doses of this oil three times a day, or

he would fairly lay himself open to a suspicion of criminality. If pregnancy were only *suspected*, this would be sufficient to deter a practitioner of common prudence from prescribing in any dose a drug which may exert a serious action on the system. (A report of the case of Mr. Pascoe will be found in the Med. Times and Gazette, April 17, 1852, p. 404.)

The oil of savin is obtained by the distillation of the tops in the proportion of about three per cent. It has a yellowish colour, and the peculiar terebinthinate odour of the plant, by which alone it may be recognised. [We have already spoken, ante 124, of the oil of tansy as a popular abortive in the U. S. A very interesting report of a case of poisoning from this cause is given by Dr. John C. Dalton, Jr., in the Am. Jour. Med. Sci., Jan., 1852, 136. Patient, a healthy-looking girl about 21 years old, took f. ℥j. and f. ℥iij. of oil of tansy, about six hours after a hearty dinner. She was found insensible and in convulsions soon after she must have taken the drug. Death ensued at the end of three hours and a half altogether. A strong odour of tansy was observed in the breath before death, and in the peritoneal cavity, stomach, and interior of the heart at the autopsy. The uterus contained a well formed fœtus about four months' old, which did not either in itself or its membranes present any evidence of having been disturbed. Dr. D. refers to another fatal case of similar character, (Am. Jour. Med. Sci. May, 1835,) in which a woman, but a few weeks pregnant, took f. ℥ss. of the oil and did not entirely lose her consciousness until three-quarters of an hour had elapsed, although she was convulsed at intervals before that time. She died without abortion within two hours after taking the poison.—H.]

It is remarkable, that the action of the most powerful mineral irritant poisons has sometimes no effect on the gravid uterus. In July, 1845, a case was referred to me for examination by Mr. T. Carter, of Newbury, in which a female, aged twenty-two years, who had passed the fifth month of pregnancy, took a large dose of arsenic, and died in less than seven hours, having suffered from severe vomiting and purging during that time: yet abortion did not take place! In reference to the medicinal use of mercury, it may be proper to state, that Dr. Salomon has reported two cases, in which premature delivery appeared to follow the mercurialization of the system. (Casper's Wochenschrift, June, 1845; Med. Gaz. xxxvi. p. 658.)

Local applications.—In a case which occurred recently in France, it was proved that abortion had been caused by the injection of some corrosive and irritating substance into the vagina. The female genitals, as well as the abdominal viscera, were found in a high state of inflammation. (Med. Gaz. xxxvii. 171.) This is a very unusual mode of perpetrating the crime; and it is one which could hardly escape detection. An analysis of the tissues might be required, to determine the nature of the substance used.

Signs of abortion.—These have been already fully considered in a previous chapter. (See DELIVERY, ante, pp. 363 and 368.) The examination may extend to the female living or dead. In the former case, there will be some difficulty if the abortion have occurred at an early period of gestation, and some days have elapsed before the examination is made. In the latter case the diagnosis is more easy, although not always free from difficulty. One fact here requires to be especially noticed. It is now believed by many physiologists, that menstruation is a state, in some measure, vicarious to conception; and the appearances presented by the generative organs during the menstrual period, are somewhat similar to those which are observed after conception in its early stage. Mr. Whitehead remarks, that in persons who have died while the menses were flowing, the uterine walls have been found thickened and spongy, and the mucous lining more or less turgid and suffused. The cervix and labia of the uterus were tumid, the orifice patulous, and the vaginal membrane and clitoris involved in the increased action. One of the ovaries was found larger and more congested than ordinary, presenting evidences of the recent escape of an ovum. (On Abor-

tion, 196.) Unless these facts be attended to, the examiner may form a very erroneous opinion respecting the chastity of a deceased female.

Feigned abortion.—For various motives, into the consideration of which it is unnecessary to enter, a woman may charge another with having attempted or perpetrated the crime of abortion. Such a charge is not common, because, if untrue, its falsity is easily demonstrated. A young woman, admitted into Guy's Hospital, in April, 1846, charged a policeman, who, according to her statement, had had forcible intercourse with her, with having given her some substance to produce abortion, and with having subsequently effected this mechanically. She was not examined until nearly two months after the alleged perpetration of the crime, when Dr. Lever found that there was no reason to believe she had ever been pregnant. This was a case of feigned abortion. When charges of this serious kind are brought forward, they are always open to the greatest suspicion, unless made immediately after the alleged attempt, as it is then only that an examination can determine whether they be true or false. If so long delayed as in this instance, without any satisfactory reason, the presumption is that they are false.

Legal relations.—The English law relative to criminal abortion is laid down in the statute 1 Vict. c. lxxxv. s. 6. By it, capital punishment, which formerly depended on whether the female had quickened or not, is abolished. The words of the statute are as follow:

"Whosoever, with the intent to procure the miscarriage of any woman, shall unlawfully administer to her, or cause to be taken by her, any poison or other noxious thing, or shall unlawfully use any instrument or other means whatsoever, with the like intent, shall be guilty of felony, and being convicted thereof, shall be liable, at the discretion of the Court, to be transported beyond the seas for the term of his or her natural life, or for any term, not less than fifteen years, or to be imprisoned for any term not exceeding three years."

It is considered doubtful, whether, under this statute, a woman could be tried for abortion attempted *on herself.* The consent, or even the solicitation of the female for the perpetration of the crime, does not excuse the offender. The crime would never be attempted without the consent of the woman; and, therefore, to admit this as sufficient defence, would be equal to an entire abrogation of the law. The *means* must have been used with the *intent* to procure the miscarriage of a woman,—a point which will be sufficiently established by a plain medical statement of the means employed. Supposing that a drug has been used, the witness will have to state whether it be "a poison, or other *noxious* thing;" for this must be proved, in order that the prisoner should be convicted of the crime. I must refer the reader to what has been said elsewhere (ante, p. 34,) in order that he may be able to judge how far the substance administered would fall under the description above given. Whether the substance administered would or would not have the effect intended, *i. e.* of inducing abortion, is perfectly immaterial. Some uncertainty may exist as to the strict meaning of the word *noxious:*—all will allow that the word implies something injurious to the system; but a difference of opinion may arise among witnesses with respect to its application to the substance under discussion,—as, for example, with respect to rue or savin. A substance must be regarded as injurious to the system, or noxious, either according to the form, quantity, or frequency with which it is administered. Savin and rue are irritant; and become noxious when given in large doses, or in small doses frequently repeated. (Ann. d'Hyg. 1838, ii. 180.) Aloes and castor-oil are innocent when taken in small doses; but they acquire noxious or injurious properties when administered frequently, or in large quantity, to a pregnant female. To confine the term noxious, therefore, to what is strictly speaking a poison, would be giving a latitude to attempts at criminal abortion, which would render the law inoperative. (See the case of *Reg.* v. *Stroud*, Abingdon Summer Ass. 1846.) The quantity of the substance taken at once

does not affect the question, provided the dose be frequently repeated. A case in which I was consulted by Mr. Reynolds (a former pupil,) was tried at the Exeter Winter Assizes, 1844. Two powders, weighing each one drachm, were prescribed by the prisoner,—one consisted of colocynth, the other of gamboge, and with them was half an ounce of a liquid (balsam of copaiba.) They were to be mixed together, and a fourth part to be taken four mornings following. Mr. Reynolds said, in answer to the question whether such a mixture was noxious or injurious, that each dose would be an active purgative, and might thereby tend to produce abortion. One dose would not be productive of mischief in a healthy country woman, but its frequent repetition might lead to serious consequences. In an interesting trial, which took place at the Norwich Lent Assizes, 1846 (*Reg.* v. *Whisker*,) it was proved that the prisoner had caused to be taken, by the prosecutrix, a quantity of *white hellebore*, in powder, for the purpose of procuring abortion. One medical witness said, he considered hellebore to be noxious to the system, but he knew of no case in which it had produced death; and under these circumstances he did not consider himself justified in calling it a poison. Another medical witness declared that in his opinion it belonged to the class of poisons. The judge, in summing up, told the jury that that was to be regarded as a poisonous drug which, in common parlance, was generally understood and taken to be such; and he thought the evidence sufficiently strong to bring hellebore within the meaning of the statute. The jury found the prisoner guilty, alleging that in their belief white hellebore was a poison. (Med. Gaz. xxxvii. 830.) The only circumstance calling for remark in this case is, that any doubt should have been entertained by a medical practitioner respecting the poisonous properties of white hellebore. It is a powerful vegetable irritant, and has caused death in several instances; yet on this occasion it appears to have been admitted to be *noxious*, but not *poisonous*.

In reference to the proof of this crime, it is not required, under the circumstances, that any specific injury should have been done to the woman, or that abortion should have followed, in order to complete the offence. There is every reason to believe that this crime is very frequent; but its perpetration is secret. Applications are continually made to druggists, by the lower class of people, for drugs for this purpose: the applicants appear to have no idea of the criminality of the act. (See, in reference to the frequency of this crime, a paper in the Med. Gaz. xlvi. p. 487.)

[In many of the States no statute law exists on the subject of criminal abortion, whilst in others severe enactments have been passed. Thus in New York, any person who shall wilfully produce abortion, except to preserve the life of the mother, and advised by two physicians to such effect, and the result be the death of mother or child, shall be deemed guilty of manslaughter in the second degree. The enactment also goes on to recite, that whosoever shall administer any substance or employ any means to procure abortion, except in the cases just alluded to, is liable to fine or imprisonment, or both. In Ohio, Missouri, and Connecticut, somewhat similar laws exist. Vide note by Dr. G. 2d Am. Ed. of this work.—H.]

On inducing premature labour. Medical responsibility.—It may be proper to offer here a few remarks upon the practice of inducing *premature labour*, which is adopted by some members of the profession, in cases in which there happens to be great deformity of the female pelvis. This practice has been condemned as immoral and illegal; but it is impossible to admit that there can be any immorality in performing an operation to give a chance of saving the life of a woman, when by neglecting to perform it, it is almost certain that both herself and the child will perish. The question respecting its illegality cannot be entertained; for the means are administered or applied with the *bonâ fide* hope of benefiting the female, and not with any criminal design. It is true that the law makes no exception in favour of medical men who adopt this practice, nor does

it in the statute of wounding make any exceptions in favour of surgical operations; but what is performed without evil intention, would not be held unlawful. The necessity for the practice ought to be apparent;—thus, for instance, it should be shown that delivery was not likely to take place naturally, without seriously endangering the life of the woman. It is questionable whether, under any circumstances, it would be justifiable to bring on premature expulsion, merely for the purpose of attempting to save the life of the child, since the operation is necessarily accompanied with risk to the life of the mother. The grounds upon which many eminent authorities have objected to this practice are:—1. That there are few cases in which parturition, if left to itself, might not take place at the full period.—2. The toleration of the practice might lead to great criminal abuse.—3. It is attended with danger to the mother and child. It is undoubtedly true, that parturition will sometimes take place safely at the full time, even when the deformity of the pelvis is apparently so great as to lead many accoucheurs to suppose natural delivery to be utterly impossible. Dr. Lilburn has reported the case of a female who laboured under great deformity of the pelvis, but who was twice delivered in safety, and the child survived. (Med. Gaz. xix. 933.) It is therefore, not improbable that many cases of the kind are prematurely treated, which, if left to themselves, would probably do well without interference. Hence a cautious selection should be made; because the operation is necessarily attended with some risk,—it does not ensure safety to the woman and child. All that we can say is, that according to general professional experience, it places her in a better position than she would be in, if the case were left to itself. It appears to me that before a practitioner resolves upon performing an operation of this kind, he should hold a consultation with others; and before it is performed, he should feel well assured that delivery cannot take place without greater risk to the life of the mother, than the operation itself would create. These rules may not be observed in practice; but the nonobservance of them is necessarily attended with some responsibility to a practitioner. In the event of the death of the mother or child, he exposes himself to a prosecution for a criminal offence, from the imputation of which, even an acquittal will not always clear him in the eyes of the public. If the child were born alive, and died merely as a result of its immaturity, this might give rise to a charge of murder. Within a recent period several practitioners have been tried upon charges of criminal abortion,—whether justly or unjustly it is not necessary to consider; but one fact was clear, they neglected to adopt those simple measures of prudence, the observance of which would have been at once an answer to a criminal charge. Because one practitioner may have frequently and successfully induced premature labour without observing these rules, and without any imputation on his character, this cannot shield another who is less fortunate. A charge is only likely to arise where a man has been unfortunate; and the responsibility of one operator cannot be measured by the success of others. For a case in which a surgeon was transported for seven years, on conviction of this act criminally perpetrated, see Alison's Criminal Law, 628.

A case of some interest occurred at Portsmouth, in which a female died from hemorrhage, which took place during an attempt to induce prêmature labour. A small aperture was discovered after death in the left common iliac artery, and more than a pound of blood had been effused. This was ascribed to a thinning of the coats of the artery, and not to a puncture of the vessel during the operation. (See Lancet, July 22, 1848, p. 107.) For some judicious remarks on the induction of premature labour, by Dr. Radford, see Med. Gaz. xlvii. p. 583.

Is proof of pregnancy necessary?—A female may imagine that she is pregnant, when she is labouring under ovarian dropsy, or other uterine or abdominal disease. Under this mistaken view, an attempt may be made by another, also deceived as to her condition, to procure abortion; and the proof of the corpus delicti will

here rest with the medical evidence. The *pregnancy* of the female is not alluded to in the recent statute;—the words being,—"procure the miscarriage of any woman." These might at first sight appear to include the state of pregnancy; but the term "miscarriage" has a much more extensive meaning than this in a popular sense. The question in reference to the necessity of the proof of pregnancy has been hitherto variously decided by our judges. A case was tried on the Midland Circuit, July, 1838, where a medical practitioner was charged with this crime. Chief Justice Tindal held, that without positive proof of the woman's pregnancy, which, however, was distinctly alleged in the indictment, a conviction could not take place. In this instance, the woman herself denied her pregnancy, and there was no evidence in support of it. The judge directed an acquittal. On the Spring Circuit of the same year, a man was tried at Lincoln, on a charge of administering a certain noxious drug to a female, with the intent to procure a miscarriage. The jury stated their opinion that the girl was not pregnant when she took the drug. In this case the prisoner was discharged. More recently, in the case of *Reg.* v. *Haynes* (Cent. Crim. Court, 1843,) the prisoner was found guilty of administering a drug with intent to procure abortion, when the woman was clearly proved, by the dissection of her body, *not* to have been *pregnant*.

The question whether the state of pregnancy be or be not an essential condition in reference to charges of criminal abortion, has, however, been decided in the negative, on a conference of the judges, in the case of The *Queen* v. *Goodall* (Notts Lent Ass. 1846.) The deceased, believing herself to be pregnant, applied to the prisoner to procure abortion by puncturing the membranes. Some instrument was used for this purpose; and deceased, who had laboured under chronic cough, died, as it was alleged, from the maltreatment of the prisoner. The body was inspected, and it was clearly proved that deceased was *not* pregnant. The defence was—a want of proof that the prisoner believed deceased to have been pregnant, and therefore that the mechanical operation alleged to have been performed, might have been resorted to for the purpose of relieving her from other symptoms under which she was suffering. The most important point urged in the defence, however, was, that the crime of abortion was not complete without pregnancy; and therefore the prisoner could not be convicted under the statute. A verdict of guilty was rendered, but Coltman, J. on this occasion reserved the question for the consideration of the judges. At the following Assizes, Coleridge, J. delivered judgment. The judges held that the conviction was right. (Med. Gaz. xxxvii. 831.)

It is, therefore, established by this decision, that a person believing a female to be pregnant, and perpetrating on her an act which would amount to an attempt at abortion if the female were really pregnant, may be equally convicted under the statute. Hence the words "procure the miscarriage of any woman" do not necessarily imply proof of pregnancy, nor can the term "miscarriage" be considered to apply only to a woman in the pregnant condition. It is remarkable that the same questions arose under the old statute, 43 Geo. III. c. 58, in which the words "being with child" were used; yet even here Lawrence, J. held that pregnancy was not necessary to be proved, and that the crime of abortion would be complete although the woman was not pregnant. (*Rex* v. *Phillips*, Paris, Med. Jur. iii. p. 88.)

An attempt made on non-pregnant females should certainly be treated as a crime, and punished accordingly; but, medically speaking, abortion presupposes pregnancy; and if a woman be not pregnant, the carrying out of the intent by the prisoner is a physical impossibility; yet, as the law is now expounded, a person may be convicted of attempting to procure miscarriage in a female who cannot miscarry.

It would appear that according to the law of France proof of pregnancy is not essential. Dr. Bayard relates a case in which a woman was convicted, in 1846, of an attempt to produce abortion in a female who was subsequently proved not

to be pregnant, but to be labouring under ovarian disease. The prisoner was sentenced to eight years' imprisonment. (Ann. d'Hyg. 1847, i. 466.)

Abortion of monsters.—Would the law apply if the child were dead in the uterus, or if it were a monster without human shape? The symptoms indicative of the death of the child in utero have been elsewhere stated. The death of the child subsequently to the attempted abortion, might perhaps be adduced as corroborative evidence of the crime; but even if it were dead at the time of the attempt, a conviction would follow. (*Reg.* v. *Goodall*, supra.) It cannot be doubted that the expulsion of a dead child would come under the popular signification of a miscarriage; and if the words were strictly interpreted, the prisoner might be convicted whether the child were living or dead; for it has been already said, that it is not necessary that any abortion should have taken place. With respect to *monsters*, the question actually arose in a case tried at Drôme, in France, in 1841. (Gaz. Méd. Juillet, 1841; also Brit. and For. Rev. xxiv. 563.) A girl was accused of procuring abortion. The aborted fœtus, of about the sixth month, was acephalous, and there was no vertebral canal for the spinal marrow. Other organs were also deficient or imperfectly formed. The medical witnesses declared that it had never breathed, and that its life had ceased with gestation. On the upper part of the body was a wound, which had been produced by a pointed instrument, probably just before it was expelled. This they thought had caused death. The counsel for the prisoner contended that this could not be regarded as a case of criminal abortion, owing to the monstrosity of the offspring; and the jury acquitted her. As in this country proof of pregnancy is no longer required, monstrosity would make no difference in the crime.

Extra-uterine conceptions.—Would the law apply to cases of extra-uterine pregnancy? There can be no doubt that the crime of abortion would apply to cases of this description; and a person would be equally amenable for the attempt, whether the fœtus were in the uterus or in the Fallopian tube. The symptoms of extra-uterine pregnancy, especially of the tubal kind, are very similar to those of ordinary pregnancy: they are not to be distinguished from them in the early stages (see Med. Gaz. xxxvi. 103.)

Abortion of moles and hydatids.—The use of the word *miscarriage* in the statute, without any explanation of the meaning assigned to it, might, but for the decision in the case of *Reg.* v. *Goodall*, have created some difficulty on trials for abortion. In a popular sense (and here a *popular* appears to have been purposely selected in preference to a professional term,) miscarriage signifies the violent expulsion, not merely of a child, but of moles, hydatids, and other diseased growths, or even of coagula of blood. In these last mentioned cases, the woman is not actually pregnant, although she and the prisoner may imagine that she is. The recent decision in the case of *Reg.* v. *Goodall*, shows that it is unnecessary to speculate on this subject. Whether the uterus contain these morbid growths, or whether it be in the virgin state, the party accused may still be convicted of an attempt to procure *abortion*.

BIRTH. INHERITANCE.

CHAPTER LI.

EVIDENCE OF LIVE BIRTH IN CIVIL CASES—LEGAL RIGHTS OF THE FŒTUS IN UTERO—DIFFERENCES BETWEEN ENTIRE AND PARTIAL BIRTH—CASE.—SIGNS OF LIVE BIRTH INDEPENDENT OF RESPIRATION OR CRYING.—CONFLICTING MEDICAL EVIDENCE IN THE CASE OF FISH *v.* PALMER.—MOTION OF A LIP A PROOF OF LIVE BIRTH.—VAGITUS UTERINUS.—POSSESSIO FRATRIS—TENANCY BY COURTESY.—CÆSAREAN EXTRACTION OF CHILDREN—LEGAL BIRTH.—POST-MORTEM BIRTHS.—DATE OF BIRTH—MINORITY AND MAJORITY.—MEDICAL EVIDENCE IN RELATION TO PLURAL BIRTHS.—MONSTERS—WHAT CONSTITUTES A MONSTER IN LAW—DEPRIVATION OF LEGAL RIGHTS—DOUBLE MONSTERS—CHRISTINA RITTA—THE SIAMESE TWINS.

Live birth in civil cases.—The law of England has not defined the meaning of the term birth, in reference to civil jurisprudence; but if we are to be guided by the numerous decisions which have been made on trials for infanticide, it must be regarded as signifying "the entire delivery of a child," with or without its separation from the body of the mother (ante, p. 351. See also Chitty, Med. Jur. 412.) So long as an infant remains in the uterus, it is said in law to be *"in ventre sa mère;"* but it is legally supposed to be born for many purposes. (Blackstone's Comm. i. 130.) A child in the womb may have a legacy or an estate made over to it,—it may have a guardian assigned to it; but none of these conditions can take effect unless the child be born alive. So the fœtus may be made an executor; but an infant cannot act as such until it has attained the age of seventeen years! The most important medico-legal questions connected with this subject are those which arise in contested suits relative to succession, or the inheritance of property. A child which is born alive, or has come *entirely* into the world in a *living* state, may by the English law inherit and transmit property to its heirs, even although its death has immediately, and perhaps from morbid causes necessarily followed its birth. Should the child be born dead, whether it died in utero or during the act of birth, it does not acquire any civil rights; for it is not regarded as a life in being, unless it manifests signs of life after it is entirely born. Some have considered that *partial birth*, provided the child be living, should suffice to confer the same rights on the offspring as the proof of entire birth. The following case has been adduced by Dr. Locock in support of this view, although the question here was rather in reference to the actual date of birth, than to the acquisition of civil rights therefrom:—the principle is, however, the same. On a Saturday evening, a lady was in labour with her first child. The head and one arm were born two or three minutes before a neighbouring clock struck twelve. There was a cessation of pain for several minutes, during which time the child cried and breathed freely. The rest of the body was not expelled until full five minutes after the same clock had struck twelve. Was this child born on the Saturday or on the Sunday? Certainly the birth was not completed until the Sunday:—the child was still partly within the mother; the circulation was still kept up through the umbilical vessels: "but,"

continues Dr. Locock, "I gave my opinion that the child was born on the Saturday. I considered that the child had then commenced an independent existence. The fœtal life had then to all intents and purposes ceased; and respiration—a function incompatible with the condition of a fœtus—had commenced. The umbilical cord will, it is true, go on pulsating for many minutes after an infant has been brought completely into the world crying and kicking, unless it be compressed artificially; and yet no one will say that the child in such a case is not born until we choose to take the trouble to tie the navel string. The child would not have been damaged if it had remained for hours, or even days, with merely its head and arms extruded: it could have been fed in this situation." (Med. Gaz. xii. 636.) However reasonable this view may appear, a medical jurist must shape his evidence according to what the law demands. It has been elsewhere stated (INFANTICIDE, ante, p. 351,) that our judges have distinctly laid down the law, that no child can be considered to be born until the *whole* of its body has come *entirely* into the world. This is in relation to criminal jurisprudence, in which case, if in any, the rule should be relaxed; because its relaxation would tend to punish the wilful destruction of living infants partially born. This child could not, therefore, have been born on the Saturday, because the law does not regard partial birth as entire birth; and respiration and birth are not synonymous terms. Supposing this child to have died before its body was entirely extruded, it could not be said, even medically, that it was born alive; and certainly it could not be considered, according to the present state of the law, to have acquired the rights of a child born living. The reasonableness of the opinion that partial birth should suffice for all the legal purposes of entire birth, is an entirely distinct question, and one over which a medical witness has no sort of control. Whatever apparent injustice may be done by adhering to this rule in respect to the civil rights of persons, there is no doubt that the evil is really of great magnitude in relation to criminal jurisprudence; for it would appear from the present state of the criminal law, that partially-born children, although alive and healthy, may be wilfully destroyed with impunity.

On the other hand, some difficulty might arise from civil cases, if the bare extrusion of a part of the body sufficed for all the legal purposes of entire birth. It might become a casuistical question, as to how much of the body should be in the world, in order to constitute legal birth; for there is no reason why, in a medical view, the extrusion of the head and shoulders should constitute birth any more than the extrusion of a hand or a foot. If it be said that the act of respiration should be combined with partial extrusion, this would be unjust; because a child is alive,—its heart is evidently pulsating, and its blood circulating, as freely before the act of respiration as afterwards. Besides, it is admitted that children may be born alive and live for some time without respiring; and this want of respiration is no objection to these children being considered living in law. A case will be related presently where a child was legally pronounced to have been born alive, although it had certainly not respired. If, then, proof of respiration were not demanded in cases of entire, it could scarcely be required in cases of partial birth. In the event of partial being treated as synonymous with entire birth, there would be no end to litigation; and medical opinions would vary in every case. It is doubtful whether, under such circumstances, the law could be administered with any degree of certainty or impartiality. Admitting, then, that a child must be *entirely* born, in order that it should acquire civil rights, it will next be necessary to examine the medical proofs required to show that it has been *born alive*. The question here is different from that of live birth in reference to child-murder. We must presume that a practitioner is present at a delivery, in which a child is born in a doubtful state, or where its death speedily follows its birth. The civil rights of the child and its heirs will depend upon the careful observation made by the practitioner of the circumstances attending the delivery. In some instances, a medical witness will be required to form an opinion from facts proved by non-professional persons.

Signs of live birth independently of respiration or crying.—The visible respiration of a child after its birth, or as it may be manifested by its *crying*, is an undoubted sign of its having been born alive: but, as it has just been stated, a child may acquire its civil rights, although it may be neither seen to breathe nor heard to cry. The pulsation of a child's heart, or even the spasmodic twitching of any of the muscles of the body, is regarded as a satisfactory proof of live birth. The latter sign has been judicially so pronounced,—à fortiori, therefore, the motion of a limb will be considered good evidence, in an English court of law, of life after birth. It is to be observed, that the length of time during which these signs of life continue after the child is born, is wholly immaterial;—all that is required to be established is, that they were positively manifested. A child which survives entire birth for a single instant acquires the same civil rights as if it had continued to live for a month or longer. These facts will be better understood from the following case (*Fish* v. *Palmer*,) which was tried in the Court of Exchequer, in the year 1806:—The wife of the plaintiff, *Fish*, who was possessed of landed estate in her own right, died about ten years previously to the trial, after having given birth to a child which was supposed at the time to have been born dead. In consequence of the plaintiff's not having had a living child (as it was assumed) by his marriage, the estate of the wife was claimed and taken by the defendant, Palmer, her heir at law, the husband being obliged to surrender it under these circumstances. From information derived many years subsequently from some women, who were present at the delivery of the wife, the plaintiff was led to think that the child had not been born dead, and that the estate had been improperly surrendered. The action was therefore brought to contest the possession, ten years after the death of his wife; and it lay with the plaintiff to prove his allegation—that the child had been born living. Dr. Lyon, the accoucheur who attended the plaintiff's wife, had died some time before the trial; but it was proved that he had declared the child to have been living an hour before it was born, that he had directed a warm bath to be prepared, and when the child was born, gave it to the nurse to place in the bath. The child neither cried nor moved after its birth, nor did it manifest any signs of active existence; but the two women who placed the child in the bath, swore that, when it was immersed, there appeared, twice, a twitching and tremulous motion of the lips. They informed the accoucheur of this, and he directed them to blow into its throat; but it did not exhibit any further evidence of life. The principal question on the trial was:—Whether this *tremulous motion of the lips* was sufficient evidence of the child having been born alive? The medical witnesses differed. Dr. Babington and Dr. Haighton gave their opinion that had the vital principle been extinct, there could have been no muscular motion in any part of the body:—therefore the child had, in their opinion, been born alive or manifested life after its entire birth. Dr. Denman gave a contrary opinion: he contended that the child had not been born alive, and attempted to draw a distinction between uterine and extra-uterine life. He attributed the motions of the lips after birth, to the remains of uterine life. The jury, however, under the direction of the Court, did not adopt this view of the case:—they pronounced the child to have been born living; and by their verdict, the plaintiff recovered the estate of which he had been for ten years deprived.

From the result of this case, it would appear that the law does not recognise the distinction attempted to be drawn by Dr. Denman, between what he called uterine and extra-uterine life.* A distinction of this kind appears to be purely artificial;—respiration is commonly set down as a mark of extra-uterine life: but a child may breathe and die before it is born, or it may be entirely born and manifest indubitable signs of life, without respiring. Respiration, therefore, is properly regarded by the English law as only *one* sign of life,—the proof of the possession of active and vigorous life is not absolutely required. It cannot be admitted physiologically that any tremulous motion in the muscles could ever

take place spontaneously in a really dead body; and the spasmodic motion of the lips differs only in degree from the active motion of a leg or an arm. If a certain quantity of life, so to term it, were required to be proved, instead of the bare fact of its presence or absence, the most subtle distinctions would be continually drawn: thus it might be contended that unless a certain degree of respiration had taken place, it should be assumed, contrary to well known facts, that the child had been born dead. In this respect it appears to me that the law of Scotland must operate unjustly. The law of that country, in respect to tenancy, declares that a child cannot be born alive unless it has breathed; it therefore requires exclusive evidence of *respiration*. (Ed. Med. and Surg. Jour. xxvi. 369.) It would be as reasonable to demand, for exclusive proof of life, the motion of one of the extremities, as to insist upon exclusive proof of respiration; for this so varies in degree, that a child may breathe and survive its birth many hours, scarcely receiving any air into its lungs (ante, p. 294.) Would this be better evidence of live birth, than the distinct motion of a limb? Non-professional persons might be easily deceived as to the fact of respiration in these feeble subjects, and a post-mortem examination would not always remove the doubt; but no one is likely to be deceived about the motion of an arm or a leg. The power by which a limb is moved is the same as that by which the intercostal muscles are moved in the act of respiration. Besides, it is forgotten by those who would thus restrict the proof of life, that such a restriction would be attended with great injustice; for morally speaking, the right of a husband to enjoy for life the estate of a wife, should not be made to depend upon the mere accident of a child being born, or of its having survived its birth for a few moments. It has been objected to this view of the case, that the motion described may have been the mere remains of muscular irritability, and not a sign of actual life. I am unable to perceive the force of this objection. Irritability, as manifested by spontaneous motion, is not a property of *dead* matter; and the remains of irritability must, physiologically speaking, be regarded as the remains of life or of a vital power in the muscles. Could any witness have sworn that a child whose lips twice manifested a tremulous motion after its birth, was born dead? It appears to me that he would not have been justified in so doing. He would be compelled to admit that such spontaneous contractions are not observed in bodies really dead, and that they are the certain indications of some vital power still remaining. The English law recognises no intermediate state between life and death; and it does not require a certain amount of *active* life to be manifested, but merely satisfactory proof that there are some signs of vitality in the child's body after it has been brought entirely into the world. (For a case by M. Marc, somewhat similar, but in which the medical opinions were opposed to these views, see Ann. d'Hyg. 1838, i. 98.)

On these occasions the mere *warmth* of the body of a child at its birth would not be evidence of life:—the slightest trace of vital action, in its common and true physiological acceptation, would, however, without doubt, be deemed by our law a sufficient proof of the child having been born alive.

Vagitus uterinus.—Let us suppose that the evidence of a child having been born alive is stated to be that it was heard to cry:—it may be a question for a medical witness, in cross-examination, whether this is to be taken as an absolute proof of live birth. The answer must be in the negative, because a child may cry before its body is entirely born:—or it may be what is called *vagitus uterinus*, —a uterine cry after the rupture of the membranes. (See ante, INFANTICIDE.) As in all cases of this description, there must be eye-witnesses, whether professional or not, the evidence cannot rest solely upon the mere medical possibility of the occurrence of such a cry before birth; and proof will be required of the crying of the child *after* it was born.

There are two cases in which the determination of the momentary existence of

children after birth becomes of importance in a legal point of view. These are cases involving the questions of Possessio Fratris and Tenancy by the Courtesy.

Possessio fratris.—In the event of a man twice married dying intestate, and leaving a daughter by each marriage, his estate would be equally shared by the daughters of the two marriages: but if we suppose that there is a son of the second marriage, born in a doubtful state, the legal effects of this child momentarily surviving birth, manifested by some slight sign of life, would be to disinherit the daughter of the first marriage entirely, and transfer the whole of the estate to the daughter of the second marriage, she being sister to the male heir, while the daughter of the first marriage is only of half blood. The determination of this point, which does not often occur, must rest essentially upon medical evidence, when there is a want of clear proof of life after birth. (See Amos, Med. Gas. i. 738.)

Tenancy by courtesy.—This signifies, according to Blackstone, (Com. ii. 426,) a tenant by the Courts of England. The nature of this tenancy has been already explained. (See the case of *Fish* v. *Palmer*, ante, p. 389.) If a married woman, possessed of fee simple estate, die, the estate passes from the husband to her heir at law, unless there has been a child born *living* of the marriage, in which case the husband acquires a life-interest in the property. The only defence of this singular custom is, that it is of great antiquity. An unsuccessful attempt was made a few years since to substitute for it the reasonable provision, that the marriage should entitle the husband to a right, which he can now only acquire by the fulfilment of certain accidental conditions. Incurable sterility, a protracted labour, deformity in the pelvis of the wife, or the necessary performance of craniotomy on a healthy, well formed child, may, under this custom, lead to an aversion of the inheritance. The tenancy, in contested cases, is generally established or disproved by medical evidence; and the following are the conditions which the law requires in order that the right should exist. 1. The child must be born alive. A case has been already related wherein the tremulous motion of a lip was held to be a sufficient proof of live birth. 2. The child must be born while the mother is living. From this it would appear that if a living child were removed from the outlet after the death of the mother, or extracted by the Cæsarean operation from the uterus, the husband would not become entitled to enjoy his wife's estate; although the child may survive its removal or extraction, and succeed to the estate on attaining its majority. How such a case would be decided in the present day it is difficult to determine: but one instance is quoted by most medico-legal writers from Lord Coke, where, about three centuries since, the case was decided against the husband, in consequence of the child having been removed from the uterus by the Cæsarean section *after* the death of the wife. (For a very singular case involving this question in France, see Ann. d'Hyg. 1838, 98.)

Cæsarean Operation.—The Cæsarean operation has rarely been performed in England, except when the female was actually dying or dead. Dr. Goodman, of Manchester, has collected and published, from the table of Dr. Merriman and other sources, an account of thirty-eight of these operations performed in this country since 1737. It appears that out of this number only three mothers have recovered, the children, with one exception in the three cases, having died. In eighteen cases the children were extracted living. (Obstetric Record, No. 4, 1848, p. 3.) Dr. Goodman himself performed this operation successfully on a female in November, 1845. The child was extracted alive, and the woman perfectly recovered from the operation. (Med. Gaz. xxxvi. 1392.) The practice on the continent has been to undertake it while the woman was living, and the result has shown that it may thus be performed successfully both with regard to

mother and child. (See Med. Gaz. xix. 829, 878; Cormack's Monthly Journal, July, 1845, p. 541–543.) For a case in which this operation was successfully performed three times on the same person, see Brit. and For. Med. Rev., July, 1836, 270. Important legal consequences may hereafter ensue from the more general adoption of this practice in England in respect to deformed females. Thus, supposing in any case the child were removed alive while the mother was living, both of them dying shortly afterwards,—Would the husband become a tenant by the courtesy? The law says the child must be *born;* and some lawyers would find ground for arguing whether extraction by the Cæsarean operation should be regarded as "legal birth." "Illud autem valde controversum est inter jurisconsultos, an is qui editus est execto matris ventre reputetur partus naturalis et legitimus et successionis capax." (Caranza.) According to Fonblanque, the question is now settled in the affirmative—a child extracted is a child born. (Med. Jur. i. 226.) Our ancient law-authorities do not appear to have contemplated that the operation would ever be undertaken on a living female. The words of Lord Coke, which are considered to express the state of the law, are:—"If a woman seized of lands in fee taketh husband, and by him is bigge with childe, and in her travell dyeth, and the child is ripped out of her body alive, yet shall he not be tenant by the curtesie, because the child was not born during the marriage, *nor in the life of the wife,* but in the meantime her land descended." According to Mr. Hobler, the Cæsarean operation does not divert the course of descent, nor divest the husband of the life-estate, provided that the child be born alive, and the mother was living when the child was born. (Obstetric Record, iii. 66.) *Birth* and extraction by the Cæsarean operation are, therefore, treated as similar conditions.

As a proof that this operation is not always necessary where circumstances may appear to call for it, the following case, mentioned by Sir B. Brodie as having occurred in a French hospital, is of some interest. It is that of a woman whose pelvis was considered to be too narrow for the egress of the child. As she was at the full term of gestation, the Cæsarean section was proposed, but before the operators were ready to commence, the child was expelled by the natural efforts of the uterus, or, as Sir B. Brodie expressed it, the child preferred coming into the world by the old road! (Lancet, Dec. 1843.)

This, however, is not the only case of the kind on record. There is great reason to believe that continental practitioners are too officious in suggesting the performance of this operation, and that it is often undertaken to the serious risk of the life of the female, when the case, if left to nature, would have done well. A case occurred in Scotland in 1847, in which the Cæsarean operation was considered by several practitioners of experience to be the only means by which delivery could be accomplished. Fortunately for the female, the labour was somewhat rapid, and she was delivered of a dead child, weighing about three pounds, before the arrival of those who had considered that the operation would be required. (Ed. Monthly Journ. July, 1847, p. 30.) The fact is, on these occasions, nature often adapts means to ends in a most unexpected manner. An interesting case of the performance of this operation on a living female has been reported by Mr. Skey. Here sufficient time was allowed for the advancement of the labour, and it was evident to all that delivery could not take place by the outlet; that embryotomy could not be performed; and that unless the operation was resorted to, the female would infallibly sink from exhaustion. The child was extracted, but the mother died in about thirty-six hours. (Med. Gaz. xxxix. 212.)

It has been a question among medical jurists as to the period of gestation at which the operation should be performed. This would of course depend on the earliest period at which a child might be born capable of living. In reference to tenancy by courtesy, the child might be extracted alive as early as the fifth month; but it would not be likely to survive unless it was at or about the seventh

month. Some have alleged, that unless performed *immediately* after the death of the mother, the child would not be extracted living. The condition of the fœtus in utero is, however, peculiar, and quite distinct from that of a child living by the act of respiration. It is possible, therefore, that there may be a limited survivorship, and that the operation may be performed so late as an hour after the death of the mother with the possibility of extracting a living child. There are incredible accounts of children having been extracted living many hours after the death of the mother. Dr. Kergaradec states that this happened in the case of the Princess Pauline of Schwartzenburgh, who, while pregnant, was burnt to death at the ball given on the occasion of the marriage of the Empress Maria Louisa in 1810. The body was not examined until the following day, and the fœtus was then found living! (Ann. d'Hyg. 1846, i. 454.)

3. The child must be born capable of inheriting; therefore if it be a *monster* the husband does not acquire the right of tenancy. There are some other legal conditions which must also be fulfilled, but I have here confined myself to what may become matter for medical evidence.

Admitting that there are legal ways by which the obnoxious parts of this custom may be set aside during the life of the mother, it is hardly just that the knowledge of the necessity for these precautions should be left to be acquired by accident. It would be better to abolish tenancy by courtesy altogether, than to allow the succession of the husband to rest upon a casualty of this kind.

Post-mortem births.—That a child may be born after the death of the mother, and survive its birth, is proved by the following case. A woman died during labour. The accoucheur, who was summoned, found the head of the child presenting, but too high up in the pelvis to allow of the application of the forceps. He immediately introduced his hand into the uterus; and a quarter of an hour after the death of the mother, and twenty hours after the rupture of the membranes, he extracted a male infant in a state of apparent death. The child, which was well formed, was speedily resuscitated by the application of the ordinary means. (Berlin. Medicin. Zeit. July, 1836.) Had this case occurred in England, it would probably have been decided, according to the old precedent, that the husband could not become a tenant by the courtesy, because by the death of the mother the marriage was dissolved, and the land descended before the child was born. Another case of the birth of a living child after the death of the female, will be found in the Med. Gaz. vol. xlvi. p. 713.

Date of birth.—Medical evidence has occasionally been demanded in courts of law respecting the actual date of birth of individuals, in cases where a period of a few days, hours, or even minutes, was required to prove the attainment of a majority,—and therefore a legal responsibility for the performance of civil contracts into which the parties had entered, either knowingly or ignorantly, when minors. Some such cases have been decided by the evidence of the accoucheur himself,—others, when the accoucheur was dead, by the production of his case-books; and it is worthy of notice that the strictness and punctuality of some medical practitioners in making written memoranda of the cases attended by them, have in more than one instance led to a satisfactory settlement of such suits, and the avoidance of further litigation. The proof of the date of birth is also of considerable importance in cases of contested legitimacy.

Minority and Majority.—The word *minor* is synonymous with that of *infant*, and is applied in law to any one under the age of twenty-one years. The age of a person may render him incompetent to the performance of civil duties. Minors are frequently called upon to act as witnesses in civil and criminal cases. In rapes committed upon young females, it is especially important to notice whether the prosecutrix be or be not competent to give evidence. The law has fixed no age for testimonial competency; and I have never heard of the question being referred to a medical practitioner. The child is always orally examined by the court; and it is soon rendered apparent whether the witness possesses a proper knowledge of the nature and obligations of an oath. If not, his testimony is not

received, or in a case of rape the trial is postponed and the child is placed under instruction, to appear again at the following sessions or assizes. The competency of a child as a witness, therefore, does not depend on age, but upon its understanding.

According to the principles of our law, a male at 12 may take the oath of allegiance; at 14 he is considered to be at years of discretion, and becomes then responsible for his actions; at 21 he attains majority, and is at his own disposal, and may alienate his lands, goods, and chattels by deed or will. It is only when this age has been attained that an individual can be sworn to serve on a jury. The period at which a male is considered to have attained full age varies in some countries: thus, in the kingdom of Naples it is fixed at eighteen years; in Holland at 25; but generally throughout the states of Europe the law prescribes 21 years, the same as the common law of England.

A person is completely of age after the first instant of *the day before* the twenty-first anniversary of his birth-day, although forty-seven hours and fifty-nine minutes short of the complete number of days counting by hours; and this mode of calculating age and time is applicable to all the other ages before and after twenty-one. This is on the principle that part of a day is equal to the whole of a day in a legal point of view. The following case in reference to this question was decided by appeal in the House of Lords in February, 1775. An estate was bequeathed to a Thomas Sansom so soon as he should arrive at the age of 21. He was born between the hours of 5 and 6 on the morning of the 16th August, 1725, and died about 11 in the forenoon on the 15th August, 1746. The question was, whether he had, at the time of his death, arrived at the full age. In the Court of Chancery it had been so decided; but it was urged that more than sixteen hours were wanting to complete the term. This plea was overruled by their Lordships, and the decree confirmed, because the deceased was living on the day which would have completed the period. A few minutes or hours may thus determine the attainment of majority, and with this, the responsibility of minors for civil contracts.

Plural births.—This has been regarded as a subject appertaining to medical jurisprudence; but I am not aware that there is any case on record in which the evidence of a medical man has been called for respecting it. It is a simple question of primogeniture, which has been generally settled by the aid of depositions or declarations of old relations or servants present at the birth. Women may have two, three, four, or five children at a birth. Twins are comparatively frequent, but triplets and quadruplets are very rare. According to Dr. Rüttel, out of 574,293 births in Prussia in 1840, there were 6381 cases of twins, 72 triplets, and one of quadruplets. This writer knew an instance in which a woman had *six* children at a birth. (Henke, Zeitsch. 1844, 266; and Med. Gaz. xxxvi. 607.) Mr. Guthrie states, that in the Museum of the Royal College of Surgeons "there is a large bottle containing five young ladies and gentlemen, all brought forth at one birth, and destroyed by an accident," and that he was for many years acquainted with a gentleman whose mother produced twenty-eight living children in the first twelve years of her married life. (Lancet, Feb. 15, 1851, p. 176.) Mr. Russell met with a case in 1849, in which there were five children at a birth. They were all males, and all born dead. The largest was six inches, and the smallest five inches long. They were prematurely born. There was one placenta of the ordinary size, with five umbilical cords attached to it around its centre. (Lancet, Feb. 3, 1849.) The only circumstance with respect to these plural births which it has been recommended that an accoucheur should attend to, is the order of their occurrence. The first born child, according to the ancient principle of the common law of this country, succeeds to the inheritance. In cases of twin or triplet males, a practitioner would find himself much embarrassed to express an opinion as to which was first born after the lapse of a certain period, unless there were some personal peculiarity or deformity which would at once stamp the identity.

There is one case in which the law has interfered to prevent the inhe
of offspring, and this is in relation to monstrous births.

MONSTERS.

The connexion of teratology with medical jurisprudence has been most ably investigated by M. St. Hilaire. Although questions connected with these beings do not often occur, yet it is proper that a medical witness should be acquainted with certain facts respecting them. The law of England has given no precise definition of what is intended by a monster. According to Lord Coke, it is a being "which hath not the shape of mankind: such a being cannot be heir to or inherit land, although brought forth within marriage." A mere deformity in any part of the body, such as supernumerary fingers or toes, twisted or deformed limbs, will not constitute a monster in law, so far as the succession to property is concerned, provided the being still have "*human shape.*" Even a supernumerary leg would not probably be allowed to avert an inheritance! The trisceles monster, in which the third leg was a fusion of two legs, was lately exhibited in London. (See Med. Gaz. xxxvii. 619.) From Lord Coke's description, it is obvious that the law will be guided in its decision by the description of the monstrous birth given by a medical witness. It would not rest with the witness to say whether the being was or was not a monster—the Court would draw its inference from the description given by him. Various classifications of monsters have been made, but these are of no assistance whatever to a medical jurist, because each case must be decided by the peculiarities attending it; and his duty will not be to state the class and order of the monster, but simply in what respect it differs from the healthy organized being. In consequence of the want of a sufficient number of precedents on the subject, it is difficult to say what degree of monstrosity would be required in law in order to cut off the civil rights of the being. There are acephalous, dicephalous, and disomatous monsters: others again, like the Siamese twins, have two bodies united by a mere band of integument. Would an acephalous monster be considered as devoid of human shape? Would a disomatous monster be allowed to inherit as one?—to marry as one?—or how would legal punishment be inflicted in the event of one of the bodies infringing the laws? Such are the singular questions which have been propounded by medical jurists in relation to these beings; and there is obviously ample room for the exercise of much legal ingenuity in respect to these questions. According to St. Hilaire, the rule which has been followed in all countries respecting these monstrosities, is to consider every monster with two equally developed heads, whether it be disomatous or not, as two beings; and every monster with a single head, under the same circumstances, as a single being. He ascribes the origin of this rule to the performance of the rite of baptism in all Christian countries upon each head, when the monster was dicephalous. This view certainly appears rational, when we consider that with two heads there are two moral individualities; while with a single head, there is only one will and one moral individuality. But it is doubtful how far this doctrine would be received by jurists and legislators. The question whether, in a dicephalo-disomatous monster, the two beings should be bound by the act of one, either in civil or criminal jurisprudence, is a matter which, if these monstrosities were more frequent, would give rise to serious difficulties. Such a question is not purely speculative, because it might easily have been raised in respect to the Siamese twins during their stay in this country; and according to St. Hilaire, a case of this kind was actually decided in Paris in the seventeenth century, in relation to a double-headed monster. This author relates that the double monster killed a man by stabbing him with a knife. The being was condemned to death, but was not executed on account of the innocence of one of its component halves! (Ann. d'Hyg. 1837, i. 331.) According to the same authority, compound monstrosity is not transmissible by generation. The reader will find an account of the most remarkable monsters born during the present century in a paper by Dr.

Rüttel (Henke, Zeitschrift der S. A. 1844, 229.) Among them is mentioned a tricephalous monster born living in Paris in 1830. Each head was baptized under a separate name. Monsters, especially the dicephalous, are either born dead or die very soon after birth; yet within a recent period two have been known to live; the one, Christina Ritta, for nine months,—the other, the Siamese twins, for many years. The latter may be still living.

Christina Ritta was born in Sardinia in 1829. This monster was double from the head to the pelvis; the two vertebral columns being distinct as far as the os coccygis. The left bust was christened by the name of Christina, the right by that of Ritta. The monster was brought to Paris, where it died about *nine months* after its birth. An excellent model of it may be seen in the museum of Guy's Hospital, together with some good specimens of the dicephalous and disomatous varieties. In the further description of it, it may be observed, that below the pelvis the monster is single. There are two heads resting on two necks; and the union or fusion of the two busts is effected laterally towards the middle portion of the chest, so that the two corresponding breasts are almost blended. The abdomen, as well as the pelvis, evidently formed by the junction of two primitive pelves, is single. In the chest there were found two distinct sets of lungs and two hearts; but these were enclosed in a single pericardium. During life, the pulsations of these organs were so uniform that there was considered to be only a single heart. There was only one diaphragm,—a fact which accounted for the simultaneous death of both bodies; one only having been previously indisposed.

The *Siamese Twins* may be regarded, from the age which they have attained, and the probability of their continuing to live, as forming the most remarkable monster of modern times. Many professional men must have had an opportunity of seeing them when exhibited in London in 1831. They had distinct volitions, and would converse at the same time on different subjects: their movements were simultaneous, so as to appear like those of a single being. In short, they could be regarded in no other light than as two distinct beings united by a narrow band. This band of union was, however, so intimate as to render it probable that they had only one peritoneal cavity between them. When either coughed, the band swelled up in its whole length: this formed an insurmountable obstacle to their separation. It would, however, have been impossible, in relation to civil and criminal jurisprudence, to have made both responsible for the acts of one, since they occasionally differed in opinion!

For an account of a case of a monocephalic disomatous monster, which was born alive, but died soon after birth, see Ed. Med. Jour. lv. 76; and at page 435 of the same volume is an account of a dicephalous monster born at Manchester in 1840.

Malpositions, transpositions, or defects of the internal organs of any of the cavities, do not form monstrous births within the meaning of the English law. The legal question relates only to *external* shape, not to *internal* conformation. It is well known that many internally malformed persons live to a great age; and it is not until after death that malpositions and defects of this kind are discovered. In French jurisprudence the case appears to be different: if the malposition or defect were such as to become a cause of death soon after birth, the child would be pronounced not "*viable*," and therefore incapable of acquiring civil rights. Some medical jurists have discussed the question of "*viability*" in new-born children, *i. e.* their healthy organization with a capacity to continue to live, as if it were part of the jurisprudence of this country; but I am not aware of any facts which bear out this view. The English law does not regard internal monstrosity; and the case of *Fish* v. *Palmer* shows clearly, that the simple question in English jurisprudence is, not whether a child be or be not "*viable*," but whether it has manifested the least sign of life after it was entirely born. The French law is much more complex, and throws a much greater degree of responsibility on French medical jurists. (See *Viability*, post.)

LEGITIMACY.

CHAPTER LII.

LEGAL PRESUMPTION OF LEGITIMACY—DATE OF CONCEPTION NOT REGARDED—DIFFERENCE BETWEEN THE ENGLISH AND SCOTCH LAW.—CHILDREN BORN AFTER DEATH.—NATURAL PERIOD OF GESTATION—DURATION FROM ONE INTERCOURSE.—PREMATURE BIRTH—SHORT PERIODS OF GESTATION.—VIABILITY—EARLIEST PERIOD AT WHICH A CHILD MAY BE BORN LIVING.—FAMA CLAMOSA—EVIDENCE FROM THE STATE OF THE OFFSPRING.—CAN FULLY DEVELOPED CHILDREN BE BORN PREMATURELY?—PROTRACTED BIRTHS.—LONG PERIODS OF GESTATION—CASES—LONGEST PERIODS YET KNOWN—THE SEX OF THE CHILD HAS NO INFLUENCE—PERIOD NOT FIXED BY LAW.—GARDNER PEERAGE CASE—EVIDENCE FROM THE STATE OF THE CHILD—LEGAL DECISIONS—MISTAKES IN THE MODE OF COMPUTATION.

Legal presumption of legitimacy.—Every child born in lawful matrimony is considered by the English law to be the child of the husband, unless the contrary be made clearly to appear by medical or moral evidence, or by both combined. It is only in reference to *medical* evidence that the subject of legitimacy can here be considered; but it is extremely rare to find a case of this kind determined by medical evidence alone. There are generally circumstances which show that the child whose legitimacy is disputed, is the offspring of adultery, while the *medical facts* may be perfectly reconcilable with the supposition that the claimant is the child of the husband. These cases, therefore, have been repeatedly decided from *moral* evidence alone,—the medical evidence respecting the period of gestation or physical capacity in the parties, leaving the matter in doubt. The law which formerly prevailed in this country was to the effect, that if a child were born during marriage,—the husband being within the four seas of the realm (*intra quatuor maria,*) and no physical impossibility being proved, the child was legitimate. Access was presumed, unless he could prove that he was "*extra quatuor maria*" for above nine months previously to birth. (Blackstone, i. 456.) But the present state of the English law on the subject appears to be this. A child born during marriage is deemed illegitimate, when by good medical or other evidence it is proved that it was *impossible* for the husband to be the father,—whether from his being under the age of puberty, from his labouring under physical incapacity from age or natural infirmity,—or from the length of time which may have elapsed since he could have had intercourse, whether from absence or death. With proof of non-access or immorality on the part of the mother, so important on these occasions, a medical witness is not in the least concerned. In the case of voluntary separation of husband and wife, which the law does not recognise, the children born are the children of the husband unless non-access can be clearly proved. In January, 1849, a woman applied to a Police Magistrate for a summons against a man to show cause why he refused to contribute to support a child of which she declared him to be the father. It appeared that she parted voluntarily from her husband, and had lived three years with the adulterer, and during the last year this child was born. The magistrate declined granting the summons, as she had no claim upon the adulterer. There was op-

portunity of access on the part of the husband, and he alone was liable in law for the maintenance of the child. In some instances, the law assumes without medical evidence that the offspring is illegitimate, as where the husband and wife have been legally divorced "*a vinculo matrimonii.*" When children are born where the divorce is "*a mensâ et thoro,*" they are presumed to be illegitimate until the contrary appear. There is a peculiar difference in relation to legitimacy between the laws of England and Scotland. A child born of parents in Scotland before marriage, is rendered legitimate by their subsequent marriage. In England the offspring is illegitimate, whether the parents marry or not after its birth; and under the Poor Law Act, 4 and 5 Will. IV., if a man marry a single woman having a child or children living, of whom he is not the father, he is bound to maintain them, as if they were his own and born after marriage. At the same time the children are not legitimated by the marriage. In the case of *Birtwistle* v. *Vardell*, decided on appeal by the House of Lords in August, 1840, it was held that a child thus legitimated by the law of Scotland could not be allowed to succeed to his father as heir to real estate in England. The Scotch rule appears to be more consistent with natural justice; since, according to the English practice, it is inflicting confiscation on the offspring for a fault in the parents, which they had done all in their power to amend. (See also the cases *Munro* v. *Munro*, *Dalhousie* v. *M'Douall*, on appeal to the House of Lords, March, 1840.) In the case of *Munro* v. *Munro*, the child was born during the residence of its father, a Scotchman, in England, but this was not considered to invalidate the application of the principle of Scotch law. These suits are chiefly instituted in respect to the right of succession to property or claims for peerages; and medical evidence is then frequently required to clear up the case. From what has been already said, the English law does not regard the date of *conception*, which cannot be fixed, but the date of *birth*, which can be fixed. Medical evidence may relate—1, to the actual length of the period of gestation:—this may be in a given case so short or so long, as to render it impossible that the husband could be the father. 2. There may be physical incapacity in the husband—he may be too old or too young—or he may labour under some physical defect rendering it impossible that he should be the father. 3. There may be sterility or incapacity in the female, rendering it impossible that the child should be the offspring of a particular woman:—in other words it may be a supposititious child. (See SUPPOSITITIOUS CHILDREN.)

Children born after death.—It appears that a child born *after* the death of the mother, provided she be lawfully married, is legitimate, although the marriage is dissolved by the death. This is not a mere hypothetical question. Two cases have already been given (ante, p. 393) in which there was a post-mortem birth of a living child, and the facts are of especial interest in relation to tenancy by the courtesy. Whether the birth take place by the aid of art through the outlet, or by eventration as in the Cæsarean section, the husband, if the wife be at the time dead, cannot claim the estate; but the child thus born out of marriage is legitimate, and if it live, may, on attaining its majority, take the estate of which the mother was seized. (See ante, *Cæsarean Operation*, p. 391.) The fact that the English law disregards the place or date of conception might, therefore, give rise to a singular question. A child may have been conceived before the marriage of the parents, and be brought into the world by the Cæsarean operation after the death of the mother. Hence it would neither be *begotten* nor *born* in wedlock, and yet, according to the principle of the English law, it would be the legitimate offspring of the marriage!

Natural period of gestation. Duration from one intercourse.—The first point to be considered is—what is the natural period of gestation, and whether this be fixed or variable. According to the testimony of the most experienced accoucheurs, the average duration of gestation in the human female is comprised between the *thirty-eighth and fortieth weeks* after conception. Numerous facts

show that the greater number of children are naturally born between these two periods. Out of 186 accurately observed cases reported by Dr. Murphy, the greater number of deliveries took place on the 285th day. (Obstetric Report, 1844.) The cause of this variation may be, that the common mode of calculation by reference to the suppression of the menstrual discharge, even in a healthy female, must lead to a possible error of two, three, or even four weeks, since there is no sign whereby, in the majority of women, the actual period of *conception* can be determined; although the late researches of Bischoff tend to show that it may be at or about the time of menstruation, and not at an intermediate period. (Med. Gaz. xxxv. 443, et seq.; Baly and Kirke's Recent Advances in Physiology, 1848, 46.) It is, however, proper to remark, that recent observations by accurate observers are adverse to the correctness of this view. Dr. Oldham met with a case in which impregnation took place twelve days after menstruation; and he states that he has known it to occur at the respective times of ten days, twelve days, and even twenty-one days after the monthly periods; and he knows of no facts to disprove the opinion that the human female is susceptible of impregnation at any time between her monthly periods. (Med. Gaz. xliv. p. 48.) In the same volume, at page 930, Mr. Kesteven has reviewed the theory of Bischoff at some length, and to his remarks I must refer the reader.

On the other hand, accidental and isolated cases have already proved that a great difference naturally exists among females with respect to the period of gestation; and it is probable that in no two is it necessarily the same. Thus, when there has been only one intercourse, the duration of pregnancy may be easily calculated without reference to any changes in the female constitution: for thereby the date of conception would be accurately fixed. Observations of this kind have shown that females have differed from each other; and in several instances they have exceeded or fallen short of the period of forty weeks, which has been usually set down as the limit of natural gestation. In three cases of this kind known to Dr. Rigby, labour came on in 260, 264, and 276 days. (Med. Times, March 14, 1846, 471.) In three other instances of recent occurrence, privately communicated to me by Dr. S. W. J. Merriman, labour commenced at 281, 283, and 286 days respectively after one intercourse; and in a case which occurred to Dr. Reid, the labour did not commence until after the lapse of 293 days from a single intercourse. (Lancet, July 20, 1850, p. 79.) In a case by Mr. Skey, reported in a former edition of this work, the period alleged was 293 days; but the woman subsequently confessed that there had been several intercourses. Dr. Reid's table, above referred to, will be found the most complete. Hence it will be perceived that in well observed cases, where there could be no motive for misstatement, and in which the characters of the females, some of whom were married and had already borne children, were beyond the reach of suspicion, a difference of not less than *thirty-three days* has been observed to occur,—*i. e.* between the earliest case recorded by Dr. Rigby, and the latest reported by Dr. Reid. This is worthy of remark, because in a case to be related hereafter (*Luscombe* v. *Prettyjohn*, post, p. 415,) the judge held that 299 days, only six days longer than in Dr. Reid's case, was an *impossible* period for human gestation! Dr. Macilwain, U. S., has reported a case of gestation, which must have extended to 296 or at least to 293 days. (Amer. Jour. Med. Sci., July, 1848.) In the same journal for July, 1845, page 241, there is recorded the case of a woman, a primipara, who was delivered on the 309th day after a single intercourse.

Dr. Lockwood has published the following as the result of his experience. The actual duration of the term of gestation in the human subject was ascertained by him in four cases:—No. 1, aged 19, duration 272 days, first confinement; No. 2, aged 30, first confinement, duration 276 days; No. 3, aged 17, duration 270 days; No. 4, aged 44, seventh confinement, duration 284 days, the child weighing fourteen pounds. (Brit. Amer. Jour., Dec. 1847, 214.) M. Devilliers

has still more recently published the particulars of nine cases, in which the date of conception, from a single intercourse, was accurately determined. Delivery took place at the following periods:—229, 246, 257, 267, 301, 276-281, 278-283, 270, and 266-272 days. (Gaz. Méd., Mars 4, 1848.)

Cause of the variations.—From analogical observations made on animals, it has been supposed that this variation in the period depended on the male: others have assigned it to peculiarities in the female constitution. It appears probable, from recent researches, that the duration of the pregnant state is really dependent on the relative excitability of the uterine system at the menstrual periods. Numerous facts tend to show, that notwithstanding the general suppression of the menses, there is great excitement of the uterine system at what would have been, in the unimpregnated state, the regular menstrual periods. Sometimes, as it has been elsewhere stated, this really amounts to a periodical discharge of blood. There is also great reason to believe that abortion takes place more readily at these than at other periods. Hence many eminent accoucheurs are inclined to consider that the duration of pregnancy is really a *multiple of the menstrual period;* and that in the majority of females it will occur at what would have been the tenth menstrual period, or forty weeks from the date of conception (Gaz. Médicale, 4 Decembre, 1847, p. 968;) and according to the degree of excitement of the uterine system, the child may be expelled a period earlier or a period later than that which is assigned as the more usual natural term. It is a remarkable confirmation of this view, that the menstrual function is again commonly established one month after parturition. Admitting that conception may occur at any time between two menstrual periods, this theory will explain the variations which have been noticed in the duration of pregnancy after one intercourse. Dr. Rigby thinks that parturition takes place at the fortieth week, because the development of the child then acts by distending the uterus, which in its irritable state, tends to throw it off. It is not, however, found that the duration of pregnancy is at all dependent on the size and weight of the child, or that children born at the fortieth week resemble each other in these respects. Hence the commencement of parturition cannot be ascribed to the physical conformation of the child. It would be desirable to know whether this periodicity can be invariably traced in the time at which labour commences. Some females menstruate every three weeks: so far as I can ascertain, it has not been shown that in them, the correspondence of gestation to the menstrual periods has been made out. Such females should, according to the theory, bear children to the thirteenth period from the date of the last cessation. Dr. Clay believes, from the observations which he has made, that the variation in the period of gestation is dependent on the age of the female as well as of the male. He considers that the term of gestation is extended in proportion to the age of the female, and that while in a female of 17 the period may be taken at 270 days,—in a woman of 44 it would extend to 284 days. Again, when a female has been impregnated by a male much older than herself, the term of utero-gestation is, in his opinion, longer than would be assigned to a female of this age, and *vice versâ*. (Record of Obstetric Medicine, June, 1848, 212.) A very extensive series of observations will be required in order to support this ingenious theory.

Date of conception.—Another cause of the differences may be that the date of conception is not precisely the same in different females. It is customary for physiologists to date conception from intercourse: but the researches of Bischoff and Raciborski have shown that a variable interval may elapse according to the situation of the ovum at the time. Bischoff believes that the ovum escapes from the Graafian follicle at the time when the menstrual discharge is about to cease; and he is of opinion, that to be fecundated, it must be acted on while it is in the Fallopian tube. Hence he considers, in order that impregnation should take place, that there must be an intercourse within eight or twelve days from the cessation of the menstrual discharge. Raciborski thinks the time more limited.

Out of sixteen women who gave him such information as enabled him to determine the time of fecundation, there was only one in whom this occurred so late as ten days after the cessation of the menstrual flux; and in this one, the menses had been suddenly arrested several days before their usual time of cessation, so that the extrusion of the ovum did not probably take place until about two days prior to the act of intercourse to which it owed its fecundation. (Baly and Kirke's Recent Advances in Physiology, 1848, 58.) These authors also state that Naegele is accustomed to reckon the duration of pregnancy at nine months and eight days from the last menstrual period, and in normal cases he has found this to be correct. The variation in the period from this cause is, however, probably slight.

Whatever may be the explanation adopted, it is obvious that in a medico-legal view, the only conclusion at which we can arrive is, that the period of gestation in the human female is *not*, as it was formerly supposed to be, a fixed and invariable term.

Premature births. Short periods of gestation.—From the preceding remarks we may regard all births before the thirty-eighth week as premature, and all those which occur after the fortieth week as protracted cases; and one great point for a medical witness to determine will be, whether the characters presented by a child correspond to those which it should present, supposing it to be legitimately born. When the birth is premature, this sort of corroborative evidence may be sometimes obtained; because, assuming that there has been no access between the parties before marriage, children born at the fifth, sixth, or even seventh month after marriage, cannot, if the offspring of the husband, present the characters of those born at the full period. It is not so with protracted births; for children are not more developed in protracted cases, than they are in those which occur at the usual period. (For an account of the characters presented by children at different ages, see ante, pp. 284, 372.)

In judging from the *marks of development* on the body of a child, we must make full allowance for the exceptions to which they are liable. The nearer the supposed premature delivery approaches to the full period of gestation, the more difficult will be the formation of an opinion. Although the characters of a seven months' child are usually well marked, and may be known by common observation, it is not easy to distinguish a child born at the eighth, from one born at the ninth month. Burns observes that it is possible for gestation to be completed, and the child perfected to its natural size, a week or two sooner than the end of the ninth month; and other accoucheurs corroborate this view. In a series of cases which occurred to M. Devilliers, the following were the weights of children born at the respective periods:—

229 days . . .	4·6 pounds av.	270 days . . .	6·8 pounds av.
246 " . . .	4·88 "	272 " . . .	7·3 "
257 " . . .	6·68 "	283 " . . .	6· "
267 " . . .	7·71 "		

Hence the weight of a child born in the fortieth week may be less than that of another born in the thirty-seventh week of gestation. The weight in the third case may be taken as the average weight of the mature child, and the delivery took place *three weeks* before the usual period. (See Gazette Médicale, 4 Mars, 1848, p. 168.) Thus, then, a child, born at the eighth month, may be the offspring of the husband:—at the ninth, of an adulterer; but medical facts could not enable a witness to draw any distinction. It is here that moral proofs are necessary; for without these the legitimacy of a child in such a case could not be successfully disputed. With respect to twin children the greatest differences are sometimes observed. In a case which occurred to Mr. West the first child born weighed only a pound and a half; the second weighed more than three pounds, and both lived several hours. Their uterine age must have been the

same. In another premature twin case which occurred to the same gentleman, one child weighed two pounds and a quarter, and the other two pounds and three quarters. (Med. Times, Feb. 23, 1850, p. 147.)

The *survivance of a child* has been supposed to furnish additional evidence; for it is well known, that under a certain age children are not born living, or if born living, they speedily die. Therefore it has been argued, if a child born at the fifth or sixth month after the first cohabitation be born living or survive, this should be taken as a proof of its illegitimacy. The following remarks will, however, show that an argument of this kind may be overstrained.

Viability. Earliest period at which a child may be born living.—According to the English law, it is not necessary that the child, when born, should be capable of living or *viable*, in order that it should take its civil rights. Thus it may be born at a very early period of gestation:—it may be immature, and not likely to survive: or again, it may be born at the full period of pregnancy, but it may be obviously labouring under some defective organization, or some mortal disease, which must necessarily cause its death within a very short period after its birth. Fortunately, all these points are of no importance in relation to the right of inheritance: the English medical jurist has only to prove that there were signs of *life* after birth,—whether the child were mature or immature, diseased or healthy, is a matter which does not at all enter into the investigation.

In this respect, our law appears to be more simple and just than that which prevails in France. By art. 725 of the Code Napoléon, no child which is born alive, can inherit, unless it be born, as the law terms it, *viable*. The meaning of this word is not defined by the law itself, and there are probably no two lawyers, or physicians, of that country, who place upon it the same interpretation. The French law seems to intend (Devergie, i. 700; Briand, 173,) by viability in a new-born child, that it should be capable of living out of the womb of its mother, and independently of her;—also that it should be capable of living for a longer or shorter period after birth. It would have been difficult for any system of jurisprudence to have laid down a more vague or incorrect principle than this; and medical witnesses may consider themselves fortunate, that in this country they have not to take part in the litigation to which such a principle must necessarily give rise.

The effect of the French law is this:—a child may be born alive; it may breathe and cry, and survive its birth for some considerable time; yet upon arbitrary medical principles, founded upon the period of gestation at which the child is born, on its length, its weight, the colour of its skin, the length of its hair, and form of its nails, it may be pronounced not viable; *i. e.* not capable of inheriting and transmitting property! But then, again, the child may be externally pronounced viable, and live four or five days; yet, on inspecting the body after death, if disease of the lungs, brain, or any organ, which had its origin previous to *birth*, be found, it will be pronounced the contrary, and the rights of property are thus made to rest upon the most trivial and unsettled conditions. The presumption is, however, in favour of the legal rights of the offspring, when it has been clearly proved that it has lived after it was born. The viability of the child is presumed, and those who would then benefit by the allegation of non-maturity, must prove it. (Briand, Man. Complet de Méd. Lég. 1846, 173.)

It may at first sight appear to some not quite consistent with justice, that a child which is born immature, or labouring under disease, owing to which it cannot long survive its birth, should possess the same rights of inheritance as one which is born mature and perfectly healthy; but this evil to society, if it be admitted as such, is of far less magnitude than the adopting of a system which must constantly lead to subtile casuistical distinctions, and thereby create error and confusion. So long as there is no well defined line between a child which is considered capable of living and one which is not, gross injustice must necessarily be inflicted by any rule of law similar to that which is admitted in the Code of France.

The question to be considered is,—What is the earliest period at which a child can be born, to enable it to live and to continue in life after its birth? It is now universally admitted, that children born at the seventh month of gestation are capable of living, although they are more delicate, and in general require greater care and attention to preserve them, than children born at the ninth month:—the chances are, however, very much against their surviving. It was the opinion of Dr. William Hunter, and it is one in which most obstetric authorities agree, that few children born *before the seventh month* are capable of arriving at maturity. They may be born alive at any period between the sixth and seventh months, or even, in some instances, earlier than the sixth: but this is rare, and if born living, they commonly die soon after birth. There is one case on record, of a child having been born living so early as the *fourth month* of gestation (Brit. and For. Med. Rev. ii. 236;) and another of recent occurrence, in which a female aborted at the fourth month and a half of pregnancy. M. Maisonneuve was not called to this case for two hours: he then found the fœtus in its membranes, and on laying these open, to his surprise it was still moving. He applied warmth, and partially succeeded in restoring it; for in a few minutes the respiratory motions were performed with regularity, but the child died in about six hours. (Journal de Médecine, and Med. Gaz. xxxix. 97.) In two instances of abortion about the *fifth* month, Dr. Davies, of Hertford, noticed that the fœtus showed signs of life after its birth, by moving its limbs (Med. Gaz. xl. 1022;) and the following case, in which a child, born at the *fifth* month, survived upwards of twelve hours, is reported by Mr. Smythe. A female in her second pregnancy, and in the 147th day of gestation, had severe flooding with rupture of the membranes. Labour occurred on the following night, when a small but well formed fœtus was expelled, giving no other indication of life than a feeble action of the heart and a strong pulsation in the umbilical cord. It was resuscitated, and cried as strongly as a child born at the full period of pregnancy. It weighed less than two pounds, and measured exactly twelve inches. It swallowed some nourishment, but died about twelve hours after birth. The membranæ pupillares were entire,—the testicles had not descended,—the head was well covered with hair. The length and weight, as well as the presence of hair, indicate a fœtus between the sixth and seventh months; but, as it is alleged by the reporter, that from peculiar circumstances, the mother of the infant was correct in the dates, we are compelled to infer that this was an extraordinary case of premature development. There was clearly nothing in the organization of the child to prevent its growing to the age of maturity; in other words, it was *viable*. (Med. Chir. Rev. July, 1844, 366.) Another case is reported, in which a child born at five months and a half survived its birth between three and four hours (Med. Gaz. xix. 865;) and on a trial for child-murder (*Reg.* v. *West*, Nottingham Lent Assizes, 1848,) a midwife was indicted for causing the death of a child, by bringing about the premature delivery of the mother, when she was between the fifth and sixth month of pregnancy. The child in this instance lived five hours after its birth. Capuron mentions an instance where a child was born at the sixth month and a half of pregnancy, and at the time he reported the case, the child was two years old, and enjoyed excellent health. In another instance, the child was born at the same period, and lived to the age of ten years. (Méd. Lég. des Acc. pp. 162, 208.) In a case which fell under my own knowledge, a child was born at the sixth month and a half of gestation, and lived a fortnight. (See another case, Med. Gaz. xxxii. p. 623.) Capuron considers that a child born at the 180th day, or at the sixth month after conception, might be sufficiently mature to live; *i. e.* that there would be no reason to presume that it was illegitimate, merely because it survived its premature birth. On the other hand, if born before the sixth month with sufficient maturity to live, this fact, although by no means a proof, affords, in his opinion, a strong presumption of its illegitimacy. Of eight cases of children born living (by abor-

tion) at the sixth month, Mr. Whitehead states that seven perished within six hours after birth, and one only attained to the age of ten days. (On Abortion, 249.) Dr. Rüttell, who has examined this subject with great care, states, as the result of his experience, that he attended a married woman, who was afterwards delivered of a living child in the *fifth month* of her pregnancy. The child survived its birth for twenty-four hours. He delivered another woman in the *sixth month* of her pregnancy, of twins,—one was dead, and the other continued alive for three hours, its life being indicated only by the visible pulsation of the heart: there was no perceptible respiration. This fact corroborates the remarks made elsewhere, as to life without respiration, in cases of infanticide (ante, p. 294;) it has also an immediate bearing on the proof of life in reference to tenancy by courtesy (ante, p. 391.) In another instance of the birth of male twins at the *sixth month*, each weighed three pounds. Dr. Rüttell saw them a year after their birth, and they were then two healthy strong children. (Henke, Zeitschrift der S. A., 1844, 241.) Dr. Barker, of Dumfries, has recently reported a case, in which a child was born at the 158th day of gestation, or twenty-two weeks and four days after intercourse. The size and weight of the child corresponded with the period at which it was born. It weighed one pound, and measured eleven inches. It had only rudimentary nails, and almost no hair, except a little of slightly reddish colour on the back of the head. The eyelids were closed, and did not open until the second day. The nails were hardly visible; the skin was shrivelled. The child did not suck properly until after the lapse of a month, and she did not walk until she was nineteen months old. When born it was wrapped up in a box, and placed before the fire. Three years and a half afterwards this child was in a thriving state, and very healthy, but of small make. She weighed twenty-nine pounds and a half. (Med. Times, Sep. 7, 1850, p. 249; also Oct. 12, p. 392.) Mr. Annan, surgeon, of Kinross, has recorded a case in which a child was born between the end of the sixth and the middle of the seventh month, and lived for a period of four months and eight days. It weighed a pound and a half when seven days old. (Med. Times, Sept. 9, 1848, p. 304.) In a case which occurred to Dr. Outrepont, of Bamberg (reported in Henke's Zeitschrift, vol. vi.,) there was the strongest reason to believe that gestation could not have exceeded twenty-seven weeks. The child weighed, when born, one pound and a half, and measured thirteen and a half inches. The skin was covered with down, and much wrinkled,—the extremities were small,—the nails appeared like white folds of skin, and the testicles had not descended. It breathed as soon as it was born, and by great care its life was preserved. It is singular that its development was very slow, until it reached what would have corresponded to the forty-second week of gestation. Dr. Outrepont saw this child when it had attained the age of eleven years, and then it appeared of the size of a boy of eight years. The only remarkable point about this case is the length of time which the child lived. In a case quoted in the Lancet, Aug. 23, 1851, p. 177, a child born at six months and ten days was thriving satisfactorily when four months old. (See also Med. Times, Feb. 16, 1850, p. 129.) It is therefore clear, that children born at the seventh, and even at or about the sixth month, may be reared, and that their *survivance for months or years* cannot be taken as evidence of illegitimacy. In forming a judgment on these occasions, we are bound to look less at the *period* at which the child is born, than to the marks of *development* about its body. The case of Mr. Smythe (supra) is corroborative of this view. Such, I believe, are the principal medical facts connected with the question of *premature births;* and the following singular case will serve as an illustration of the difficulties sometimes experienced in forming a medical opinion.

The Kinghorn case.—In October, 1835, an investigation (*fama clamosa*) took place before one of the Presbyteries of Scotland, in reference to certain reports which had been circulated, to the prejudice of a minister of the district.

It appears that the marriage of this gentleman took place on the 3d of March, and his lady gave birth to a female child on the 24th of August following; *i. e.* one hundred and seventy-four days, or nearly *six calendar months*, after the marriage, and the child continued to live until the 20th of March, 1836. When born it was very weak, and according to the evidence of the accoucheur and others, who saw it, it was decidedly immature. The birth of a living child, together with its survivance for so long a period, led, however, to the report that there must have been intercourse between the parties previously to the marriage. It was contended that the period was too short for the child to have been begotten in wedlock. Dr. Hamilton, of Edinburgh, on being applied to by the Presbytery, said that his own experience was opposed to the probability of a child born at the sixth lunar month surviving: (the time in this case was six lunar months and six days;) but he referred to two cases, where children born under similar circumstances had survived their birth for a long period. In one, the lady was delivered within five lunar months (twenty weeks) after the marriage, and Dr. Pitcairn and others gave it as their opinion, that it had been begotten within wedlock: in the other, a woman gave birth to a child nineteen weeks after conception, and it lived a year and a half. Dr. Thatcher, who examined the child in the case here reported, nineteen days after its birth, gave it as his opinion, that it might have been begotten on or after the 3d of March; and the circumstance of its having been reared in the premature state in which it was born on the 24th of August following, was no objection to this opinion. He considered the complaint made against the minister groundless. The case went through several appeals, and was not finally decided until May, 1839, when the libel was found *not proven*, and the defendant was absolved from censure. Many medical witnesses gave evidence on the occasion—the majority of them being strongly in favour of this having been a legitimate and premature birth. (See Record of Proceedings, &c., Edinburgh, 1839; Med. Gaz. xvii. 92; also Med. Chir. Rev. xxxi. 424.) Although not connected with the medical part of the case, it should be observed, that the character of the parties was free from all suspicion, that no concealment had been practised by them, and that no preparation had been made for the early birth of the child. There were, it is true, *unusual marks of development* about this child, considering the early period of its birth; yet these were not sufficient, any more than the fact of its surviving, to induce the belief that it had been begotten out of wedlock. One case has been already mentioned, where a child born at a still earlier period survived several hours, and others where children born rather later lived for two and ten years. It would be in the highest degree unjust to impute illegitimacy to the offspring, or a want of chastity to the parents, merely from the fact of a six months' child being born living and surviving its birth. There are, indeed, no justifiable medical grounds for adopting such an opinion,—a fact clearly brought out by a question put to Dr. Campbell, the chief medical witness in favour of the alleged antenuptial conception. In his examination in chief, he admitted that he had himself seen the case of a six months' child who survived for *several days*. He was then required to say, whether he could assign any reason why, if after such a period of gestation it is possible to prolong life for *days*, it should not be possible to extend it for *months!* He could obviously give no reason. (Record of Proceedings, &c., 55.) The great injury which may be done by speculative medical opinions, such as those given against the chastity of the parties concerned in these proceedings, will be apparent from the record of a case which occurred to Dr. Halpin, of Cavan, in 1845:—A healthy woman, æt. 34, the mother of five children, was delivered in the *sixth month* of her pregnancy of a female child. It was rolled in flannel, and laid in a warm place. Contrary to expectation, the child survived, sucked vigorously, and was healthy in every respect. The ossification of the bones of the head was very imperfect, and the sutures broad enough to admit of the middle finger being laid between them;

and the fontanelles were of corresponding large size. The weight of the child, on the fourth day after birth, was two pounds thirteen ounces; and on the thirty-fourth day, three pounds seven ounces. The child was alive and well when last seen, on the fourth of March,—*i. e.* four months after birth: she then weighed eight pounds eight ounces. After this Dr. Halpin lost sight of her, as the mother left that part of the country. (Dublin Quarterly Journal, May, 1846, 563.) See also Dr. Barker's case, ante, p. 404.

If the facts of these cases be compared with those of the Kinghorn case, it will be found that there were no just medical grounds for the imputation that the child had been begotten out of wedlock. In the latter, six months' children were living and healthy after four months and three years and a half, respectively; in the former, it was supposed that the child must have passed the sixth month (of uterine life,) because it survived seven months! In Dr. Halpin's case, the child, four days after birth, weighed two pounds thirteen ounces—(a six months' child rarely exceeding two pounds:) in the Scotch case, it was considered that it must have been much beyond the sixth month, because (a fortnight after its birth) it weighed three pounds! These cases deserve to be borne in mind, when much reliance is placed upon the appearances presented by children, as positive evidence of the stage of uterine life which they have reached.

Evidence from the state of development of the offspring.—The fact that a child born at nine months is small, and resembles in size and weight a seven or eight months' child, cannot be taken as a proof of illegitimacy. It has been already stated, that children born at the full period vary considerably in size and weight; yet, although small, there are commonly about them the appearances of *development*. This is especially apparent in the features. If there be a general want of development, and if certain fœtal peculiarities remain—as, for example, the membranæ pupillares, or (in the male) the testes do not occupy the scrotum,—these facts may lead to a strong presumption that the child has not reached the full period. On the other hand, when a child is born with all the signs of maturity about it, at or under seven months (from possible access of the husband,) then there is the strongest reason to believe that it is illegitimate. No instance is recorded in which children have reached maturity two months earlier than the natural period. There are many cases of retarded development; but, so far as I know, this kind of premature development in the fœtus has never been observed. In the Scotch case above related, the child was more developed than such children commonly are at the same period of uterine life: but these differences are slight. The great progressive stage of development is in the last two months of gestation: the changes which the fœtus undergoes are greater, and more marked, at this than at any other period. At eight months there might be some difficulty in forming an opinion; but it appears to me, that at seven months it would be impossible for an accoucheur to commit an error on this point. If the body of the child were large and fully developed, he would consider it to have been born at the full period of gestation; and attribute any opinion which had led to the supposition that it was a seven months' child, to have arisen from some mistake in the calculation. Dr. Beck states it as *barely* possible that a child born at seven months may *occasionally* be of such a size as to be considered mature; yet he qualifies this statement by the remark, that the assertion is most frequently made by those whose character is in danger of being destroyed. The question is, however,—Has a really seven months' child ever been born, so developed as to be mistaken for one that was mature? He adduces no case of this kind in support of his opinion. There can be no doubt of the correctness of his statement, that a *mature* child, born *before* seven full months after connexion, ought to be considered illegitimate: but it would be difficult to maintain this position consistently with the above admission; for a child is as likely to acquire premature development during the latter half of the sixth as at the seventh month. In making this remark, I ought to mention that Dr. Rüttel, an experienced

observer, has met with several cases where females have been delivered two and even three weeks before the expiration of the ordinary term (two hundred and eighty days,) and the children were as perfectly developed, to all appearance, as those born at the full period. (Henke, Zeitschrift, 1844, p. 246.) This question may arise in cases of divorce, and the fact be received as proof of the act of adultery. In the case of *Maclean*, (House of Lords, March, 1851,) it was proved that the earliest intercourse which could have been had with the husband was on the 22d December, 1847; while according to the medical evidence the child was born on the 6th July, 1848, and was a full-grown nine months' baby. This was received as proof of adultery on the part of the wife. In *Heathcote's* case (March, 1851,) it was proved that the husband returned on the 24th November, 1849, and the wife was delivered of a full-grown child on the 18th May, 1850. This was also taken as proof of the alleged adultery.

In *Hawkins'* case, May, 1852, it was proved that there had been no access of the husband, owing to his absence between the 16th May, 1850, and the 23d March, 1851. A full-grown and *mature* child was born on the 2d June, 1851: hence, to have been the child of the husband, gestation must have been extended to a year and sixteen days, or reduced to a period of only seventy-one days. This was taken as clear proof of adultery on the part of the wife. It is to be remarked of this case that the husband had slept with his wife after his return, even up to five minutes of the time of her delivery, without suspecting his wife's pregnancy; and her female attendant, who had been in the habit of seeing her daily, did not observe any alteration in her personal appearance. This created a little difficulty in the case; but it merely serves to show either that a visible prominence of the abdomen is by no means a constant accompaniment of the pregnant state, or that it may be very readily concealed.

The following case in reference to development has been communicated to me by one of my pupils. It is well calculated to show the characters of a seven months' child, and to corroborate the views adopted by physiologists respecting the means of determining the period of uterine life which the fœtus may have reached. Mrs. F. was married on the 7th April, 1846, and was delivered by my informant of a male child at seven o'clock on the evening of the 19th October following,—the period of gestation being equal to 195 days, or twenty-eight weeks. The infant cried strongly, and lived until nine o'clock the following morning. The skin was of a deep pink or rose colour, beautifully soft, and covered with a fine down. The membranæ pupillares were absent, and the pupils were well formed,—the nails were complete,—the testicles had *not* descended into the scrotum,—its length was fifteen inches, and its weight two pounds eight ounces. Its weight, and the non-descent of the testicles, at once referred it to a uterine age of seven months.

In addition to the other circumstances mentioned, it is observed that children at the seventh month do not so readily take the breast as those which have reached the ninth; and their power of sucking is much more feeble.

When the question comes to this, that to be the offspring of the husband, it must be a *six months'* child, and it is born *mature*, there can be no room to doubt its illegitimacy. This question was raised in the Exchequer Sittings (January, 1847,) on a motion for a new trial in the case of *Eager* v. *Grimwood*. The action was one of seduction, and the principal witness in the cause, a young girl, on being cross-examined, stated that she was first connected with the defendant a few days before Christmas, 1845, and that the birth of the child took place in the June following,—*i. e.* in about six calendar months. Under these circumstances, as the child appeared to have been full grown, the Chief Baron, assuming the statement of the dates to be correct, intimated it to be his opinion, that the action could not be maintained, as the foundation of it was the loss of service, arising from the defendant's intercourse with the daughter, and her subsequent confinement; and that it was impossible that he could have been the

father of the child in question. The jury found for the defendant. A rule for a new trial was granted, chiefly on the ground that the woman had, from confusion in giving her testimony, made a mistake in the period.

Protracted births.—Long periods of gestation.—The questions connected with retarded gestation have given rise to considerable discussion in legal medicine. That gestation may be retarded or protracted beyond the fortieth week, is now, I believe, not disputed by any obstetric writer of reputation. Some individuals have denied it, because they have not met with such cases; but the medico-legal relations of such questions do not depend upon the solitary experience of practitioners. It is only by the accumulation of well ascertained facts from all authentic sources that medical knowledge can be made available to the purposes of the law: otherwise, owing to the mere accident of a witness not having met with any exceptional case, a Court may be entirely misled in its judgment by trusting to his opinion. It is more important to attend to this, because most of the cases involving questions of contested legitimacy or the chastity of individuals, turn upon protracted rather than upon premature delivery.

In the standard works on midwifery will be found authentic reports of cases in which gestation continued to the forty-first, forty-second, forty-third, and, even the forty-fourth week. Dr. Murphy regards 301 days, or 43 weeks, as the average limit of gestation. (Obstetric Report, p. 4.) Dr. Lee met with a case in which he had no doubt that the pregnancy lasted two hundred and eighty-seven days:—the labour did not take place until forty-one weeks after the departure of the husband of this lady for the East Indies. (Med. Gaz. xxxi. 917.) Dr. William Hunter met with two instances where gestation was protracted until the forty-second week. Dr. Montgomery met with a case in which delivery did not ensue until between the forty-second and forty-fourth week. (Med. Gaz. xix. 646.) Dr. Merriman has published a valuable table on the subject of protracted gestation, on which the most experienced accoucheurs have been in the habit of relying. Of one hundred and fourteen pregnancies calculated by him from the last day at which the females menstruated, and in which the children appeared to be mature, the following were the periods:—

In the 37th week	3	In the 41st week	22
38th	13	42d	15
39th	14	43d	10
40th	33	44th	4

Another well marked case, occurring forty-four weeks precisely after the cessation of the catamenia, has been communicated to me by Dr. S. W. J. Merriman.

From these results Dr. Merriman considers that the greater number of women complete gestation in the fortieth week from the cessation of the catamenia, and next to that in the forty-first. In the evidence given by this gentleman before the House of Lords in 1825, the case of longest protraction on which he was able to rely, was that of a married female, who was in the habit of calculating from the last day on which her monthly period ceased. This lady was delivered 309 days, or forty-four weeks and one day from the time at which she supposed that she had conceived. In another case mentioned by the witness the period was 303 days, or forty-three weeks and two days from the termination of the last monthly period. It was objected to this evidence by the Attorney-General that as it was impossible to fix the exact date of conception, and as the female might have really conceived only a day or two before the expected return of menstruation, twenty-eight days, or four weeks, might be deducted from the periods assigned by the witness. Admitting the validity of this objection,—and the fact upon which it is based is indisputable,—it followed that the longest protracted case observed by Dr. Merriman might have really been only a case of ordinary gestation extending to forty weeks and one day. An objection of this kind may of course be successfully urged in law to

any inference from a calculation so made, and it was thus that in the Gardner Peerage case, the medical evidence failed to render it certain that gestation might be so protracted as to cover the legitimacy of the claimant. It is therefore obviously of the greatest importance, in considering this question, to make full allowance for a possible error; and in calculating the pregnancy from the last day of the last menstrual period, to deduct the interval of menstruation, if known, and at least twenty-eight days, if unknown. It must be remembered that in these cases of contested legitimacy, the offspring is commonly the result of a *single* intercourse. The date of conception is therefore fixed, and a comparison can only be instituted between the period of gestation thence deduced, and the periods taken in other cases which are free from any chance of error.

My friend, Dr. Murphy, of University College, has furnished me with some valuable data in reference to this subject. Out of 182 accurately observed cases in which special inquiries were made of the females, the deliveries took place from the date of the last appearance of the catamenia at the following periods in weeks. The details are fully given in his Report of the Obstetric Practice of University College Hospital for 1844.

In the 33d week	5	In the 40th week	25
34th	3	41st	32
36th	6	42d	25
37th	11	43d	19
38th	12	44th	9
39th (9 months.)	24	45th	11

The most protracted of the cases in the table was No. 182. The period of gestation was 329 days, or deducting twenty-eight days (the ascertained menstrual interval,) 301 days, or forty-three weeks; *i. e.* three weeks beyond the usual period, or that allowed by those medical witnesses who gave evidence against the possible protraction of pregnancy in the Gardner Peerage case.

It will now be proper to direct attention to some still more remarkable protracted cases which are recorded by writers of repute, and which have either fallen under their own observation, or under that of friends upon whose judgment they could rely. Among these a case is reported by Dr. Beck to have occurred in America in 1840, in which gestation is stated to have extended to 313 days, or forty-four weeks and five days; but, as the facts are not fully detailed, I prefer taking for illustration two well marked cases observed by Dr. Murphy, and recorded in his Obstetric Report for 1844. In No. 183, a healthy married woman, æt. 26, pregnant with her third child, was delivered 342 days from the last appearance of the menses. The date at which they were last observed by her was the 1st September, and the woman was delivered on the 9th August of the following year. In No. 184, a married woman, aged 33, pregnant with her fifth child, delivery took place at an interval of 352 days. The menses last appeared on the 1st of March, and the child was born on the 16th of the following February. In both instances the menstrual interval was observed to be four weeks; therefore, deducting twenty-eight days, the periods of gestation in these two cases will be—

No. 183	(342—28)	314 days	44 weeks and 6 days
No. 184	(352—28)	324 "	46 " 2 "

As these cases are of a somewhat remarkable kind, the facts are specially detailed. Dr. Murphy observes, in respect to the longest case, "that the date of the last menstrual discharge in this, as in other cases, was recorded *before* parturition took place; thus preventing the possibility of misstating this fact for the purpose of making it appear that gestation was inordinately prolonged. Menstruation, however, is sometimes suspended, or may return at irregular intervals during pregnancies; it was possible, therefore, that the catamenia might have

appeared in this irregular way, occurring but once, and that time being pa
months before conception. It was necessary to avoid this source of error.
irregularity did not take place in either of these cases, and in the last
there was an interval of four years between the present and the previous
nancy, *during the whole of which period to the time of conception* the
were quite regular." (Report, page 7.) Dr. Murphy has since
another case which occurred in his practice in 1849: the duration of
was 351 days, or deducting the monthly period (351—28) 323 days. (
Gaz. 1851, vol. xlviii. p. 683.) I am indebted to Dr. S. W. Merriman
reference to another case, which goes one day beyond the longest of Dr.
phy's, *i. e.* 325 days, or forty-six weeks and three days. This is
Dr. Power, in his work on Human Pregnancy.

These cases appear to me to be conclusive of the question, and to
complete answer to the objection taken to Dr. Merriman's evidence in the
Peerage case. All women may not have such unusually protracted
indeed, it is well ascertained that no two women are alike in this respect,
two successive pregnancies in the same female are alike in duration.
again, all practitioners may not have met with such protracted cases.
being clearly ascertained in one case, renders it unnecessary to search
unless we doubt the credibility of a reporter well qualified to observe,
could have had no motive to serve but that of stating a plain truth as it
before him. On this part of the question I think it is unnecessary to
The advocates of a fixed and limitable period differ from each other by
of ten or twelve days, and each must either take his own experience for the
decision of this question, or it must be allowed that men of equal powers
servation with themselves have met with cases which have gone beyond
own fluctuating limits.

Dr. Murphy has so completely anticipated the objection which might be
on the ground of the menstrual function being possibly suspended from
hidden morbid cause one or two months before the actual date of
that it is scarcely necessary to make any remarks upon it. If it is to be
mitted under these circumstances, it would be only equally just to admit
any given case the ordinary and so-called fixed period, calculated from the
sation of menstruation, is based on a fallacy. Thus, it might be urged
strual function continues for several intervals after conception. The
may have conceived in the month before the cessation of the catamenia,
thus four weeks should be added to the period. Dr. Murphy observes
cases, that periodic discharges resembling the catamenia took place during
nancy; in one case to the *time of quickening*, and then ceased; in another
to the *eighth month;* in a third throughout the *whole period* of pregnancy.
all these cases the discharge was described as being in every respect
menstrual. This view of the question may appear to prove that no reliance
be placed on the time of the cessation of the catamenia as evidence of the
of pregnancy; but if, as in case No. 184, a married woman had been
regular for four years previously, the cessation of the discharge would
furnish evidence of the strongest possible kind. Its continuance might,
happens daily, have given rise to error, and have actually led to the period
unduly shortened in the opinion of the female. In the Gardner Peerage
the Attorney-General was quite willing to rely upon the cessation of the
strual discharge as a good criterion of the duration of pregnancy, when by
a mode of calculation this was not made to exceed forty weeks. But this
dition must be either taken, or rejected altogether, as evidence: if the
we have no right, in alleged protracted cases, to refer the suppression to
for the sake of shortening the period, when we do not refer its
disease, because it would tend to lengthen it: if the latter, it would be in the
highest degree unjust not to give to a claimant the beneficial presumption of

having been born legitimate, when the cases adduced in evidence *against* his claim are actually based upon precisely the same mode of calculation! Such protracted cases as those observed by Dr. Murphy may not be frequent; but it is the fact of their possible occurrence, rather than their frequency, which should be regarded in determining questions of contested legitimacy.

It has been supposed that cases of lengthened gestation were nothing more than instances of protracted parturition; the pains indicative of delivery commencing at the usual time, but continuing over a much longer period than usual. In an instance mentioned by Dr. Jörg, a woman went her full time, but the parturition lasted a fortnight longer, the symptoms appearing and then disappearing. Admitting that this occasionally happens, still it shows that gestation from a particular pregnancy may be protracted considerably beyond the ordinary period. It is impossible to admit that these protracted cases depend upon some mistake being made in the calculation of the period, since this calculation was founded on the same principles as those adopted in cases of ordinary pregnancy. Hence, if there was a mistake in the one case, there would be in the other: if an error in the exception, there would be an error in the rule. Either the average term of pregnancy is wrongly calculated by most accoucheurs at the thirty-eighth or fortieth week, or it is rightly calculated to extend occasionally to the forty-fourth, or, as in Dr. Murphy's case, to the *forty-sixth* week. But even setting aside the palpable answer to an objection of this nature, some of the cases were instances of impregnation from one intercourse; and therefore it is quite impossible that any such mistake could have arisen respecting them. (See ante, p. 400.)

The sex of the child has no influence.—There is no reason to believe that the sex of the child has any direct influence on the length of the pregnancy. It has been supposed that gestation was longer with male than female children; and evidence of this kind was tendered in the Gardner Peerage case. The medical witness stated, that the average period was 280 days for a female, and 290 days for a male child. The Solicitor-General very properly inquired—Supposing the child is an hermaphrodite, what then is the time? The witness said—He would take between the two! It is not observed that children labouring under sexual deformity are born earlier or later than those in which the sexual organs are perfectly developed. As an answer to this singular hypothesis it may be observed, that of Dr. Murphy's two most protracted cases (Nos. 183 and 184, ante, p. 409,) the one was a female, and the other a male child.

Period of gestation not fixed by law.—In all cases of contested legitimacy, the question respecting the *period of gestation*, when it arises, is left entirely open by the law. No period has been fixed within which, or beyond which, a child, if born in wedlock, will be presumed illegitimate. The decision of a Court of law would be founded, quoad the duration of pregnancy, on the opinions of experienced practitioners selected for the occasion, and each case would be decided on its own merits. Precedents can have but little influence on these occasions, because a Court may think fit to pronounce illegitimate, on non-medical grounds, a child born in the thirty-eighth week of gestation; while it may decide that another was legitimate that had been born in the forty-third week. By some law-authorities *forty* weeks are set down as the *"ultimum tempus pariendi:"*—but the impression among jurists and physicians in modern times being that the period of human gestation is wholly independent of any legal dictum, it is not the custom of the Courts to act upon this as a rule. Nevertheless, it is clear that in some cases the law must interpose, and pronounce for a reasonable limit. In the case of *Cotterall* v. *Cotterall*, decided in the Consistory Court, July, 1847, the husband had proceeded against the wife for a divorce on the ground of adultery. The main proof was based on the fact, that in order to have been the child of the husband, it must have been born after *twelve months'* gestation. The husband had left his wife in New South Wales, and was absent for that period of time without possibility of access. Dr. Lushington, without

entering into the question of protracted gestation, upon proof of the allegation at once pronounced for the divorce. Such a duration of pregnancy is not supported by any known facts, and is altogether opposed to medical probability.

In two instances, children have been pronounced legitimate, which were born the one in forty-one weeks and three days, and the other in forty-one weeks four days, after the death of the husband. In the following case (*Aveline v. Gibbs*, 1834,) the Vice-Chancellor decided that a child born ten months, or *forty-two weeks* after intercourse with the husband, was legitimate. A verdict had been already returned, establishing the legitimacy of the plaintiff; and an attempt was now made to set this aside, among other grounds, upon the plea that the offspring was illegitimate, because it had been born at so long a period after possible access. It appeared that the mother of the plaintiff for some time before and at the period of the birth had been living in adulterous intercourse; and that about *ten months* before the birth of this child she had had a private interview with her husband, when it was assumed that there had been access, but the parties did not meet afterwards. Before the adultery, they had lived together many years without having had issue; and in the present instance the child was born after a period of *forty-two weeks*,—facts which were considered to establish illegitimacy. The opinions of Sir Charles Clarke and other medical men were adduced at the trial, and these limited the extreme period of gestation to forty weeks; but they at the same time declared that the subject was involved in darkness and uncertainty. The Vice-Chancellor considered that the jury at the trial had given a proper verdict by finding for the plaintiff's legitimacy. The jury were not to decide by whom the child had been *begotten*, but whether it could *by any possibility* be the child of the husband. With respect to the period of gestation, there was no difficulty. Sir Charles Clarke, and other authorities, confessed that the subject was involved in darkness and mystery; and that the Faculty of medicine knew nothing certain about it. There was no positive evidence as to the exact day on which the child was born, nor on which the interview between the husband and wife took place. Therefore this would allow of the period of gestation being reduced to about forty-two weeks or less. The legitimacy of the plaintiff was in his opinion legally established. From this case it will be seen that a child may be affiliated on the husband, although the wife may be living at the same time in adulterous intercourse with another person.

Gardner Peerage case.—One of the most interesting cases in relation to this subject was the Gardner Peerage case, which came before the House of Lords in 1825; and a full account of which has been published by Dr. Lyall. (Med. Evid. in Gardner Peerage Case, 1827.) Alan Legge Gardner, the son of Lord Gardner by his second wife, petitioned to have his name inscribed as a peer on the Parliament roll. The peerage was, however, claimed by another person, Henry Fenton Jadis, who alleged that he was the son of Lord Gardner by his first and subsequently divorced wife. It was contended that the latter was illegitimate; and in order to establish this point, the evidence adduced was partly medical and partly moral. Lady Gardner, the mother of the alleged illegitimate child, parted from her husband, on board of his ship, on the 30th of January, 1802. Lord Gardner went to the West Indies, and did not again see his wife until the 11th of July following. The child whose legitimacy was disputed was born on the 8th of December of that year. Therefore, the plain medical question, taking the extreme view, was, whether a child born 311 days (*forty-four weeks and three days*) after intercourse (from January to December,) or 139 days (*twenty-one weeks and three days*) from July to December, could be considered to be the child of Lord Gardner. If these questions were answered in the affirmative, then it followed that this must have been a very premature or a very protracted birth. There was no pretence that this was a premature one, the child having been *mature* when born. The question then was reduced to this—Was this alleged protracted gestation of 311 days consistent with medical

experience? Many medical witnesses, comprising the principal obstetric practitioners in the kingdom, were examined on this point. Their evidence was very conflicting, but a large majority concurred in the opinion that natural gestation might be protracted to a period which would cover the birth of the alleged illegitimate child. On the moral side of the question, it was clearly proved that Lady Gardner, after the departure of her husband, was living in open adulterous intercourse with a Mr. Jadis; and on this ground Lord Gardner obtained a divorce from her after his return. He subsequently married a second wife, by whom he had the claimant, Alan Legge Gardner. It was contended that the other claimant was really the son of Lady Gardner by Mr. Jadis. The decision of the House was, that this claimant was illegitimate; and that the title should descend to the son of the second Lady Gardner.

The decision appears to have been chiefly based on moral circumstances; for had not the first Lady Gardner been living in open adulterous intercourse at the time of her husband's departure, it is highly probable, from the medical evidence bearing that way, that the legitimacy of the child would have been allowed. Again, supposing the child had been born two or three weeks earlier, the question would have resolved itself into this—who had begotten the child?—the husband or the adulterer. This could not have been decided, and then, probably, as in the more recent case of *Anderton* v. *Gibbs* (supra,) the rule of law would have pronounced the husband to have been the father. The House then must have considered, that the medical opinions, without cases to support them, could not be safely received. It is obvious that the possibility of gestation being protracted must stop somewhere, and the Court probably thought that they had here reached that point. Morally speaking, the decision could not be impugned; but medically speaking, it was incorrect; inasmuch as a court of law never pretends to settle who begat a child, when the pregnancy might by any possibility be ascribed to the husband or an adulterer. The House of Lords, however, here decided that the adulterer begat the child; and by implication their decision involved this medical point,—that it is quite *impossible* the husband can be the father of a child born forty-four weeks and three days after access! No case was adduced to show that so long a gestation had ever been known to occur; for, as it has been already remarked, the mode of calculation adopted in Dr. Merriman's cases rendered them unavailable as evidence. That in a *medical* point of view the decision of the House of Lords, so far as it related to protracted gestation, was erroneous, must now be apparent; for while their Lordships did not directly come to a resolution that the one claimant was illegitimate, because he could only have been born after 311 days' gestation, they decided that the other claimant was the only son and rightful heir of Lord Gardner. A reference to the cases reported by Dr. Murphy (ante, p. 409,) will show that gestation may be protracted to three, and even thirteen days, beyond the period denied to be possible on this occasion. Supposing this case to be re-heard, and the evidence of Dr. Murphy called for, could the House vindicate its former decision? It would be found that they had virtually pronounced to be impossible what had actually come to pass; and either the decision would be the other way, or it would be contrary to that general rule of law upon which so many decisions have been framed, that even although the wife may be living in adultery, the husband shall be presumed to be the father of her children, unless there is a clear proof of non-access—or of absolute impossibility from the duration of the pregnancy. Of the seventeen medical witnesses examined on this occasion, five supported the opinion that the duration of human utero-gestation was *limited* to *about* nine calendar months, *i. e.* from thirty-nine to forty weeks, or from 273 to 280 days; or, strictly speaking, from 270 to 280 days: one of the witnesses, indeed, said from 265 to 280 days. Those gentlemen, of course, gave their negative to the possibility, unless by miracle, that Henry Fenton Jadis, *alias* Gardner, could have been the product of a 311 days' gestation. On the other side, of twelve medical

gentlemen who seemed to agree with respect to the above-mentioned period as the natural term of gestation, most of them maintained the *possibility* of pregnancy being protracted to nine and a half, ten, or eleven calendar months, and of course to 311 days,—the alleged term of gestation at which the counter-claimant was born; and thus admitted the possibility that Mr. H. F. Jadis, *alias* Gardner, might be a ten and a half months' child. (Lyall's Med. Evid. on the Duration of Pregnancy, &c., p. viii.) The conclusion at which the majority arrived has now been confirmed by the occurrence of several well marked cases; and the facts should serve as a caution to those witnesses who on speculative subjects lay down a limit to what is *possible* merely from the experience which they may have acquired. The decision of the House of Lords, admitting that it was consistent with justice in this instance, can, it appears to me, only be defended on the principle that when a married woman has had intercourse about the same period with her husband and an adulterer, her offspring should be bastardized on the mere proof of her adultery. But this is entirely contrary to decisions in other cases (ante, p. 412.)

Within a very recent period a case has been decided in the United States in favour of the legitimacy of a child, in which gestation was protracted to 317 days, or forty-five weeks and two days. (Commonwealth *versus* Porter; Amer. Journ. Med. Science, October, 1845, p. 383.)

Evidence from the state of the child.—In these protracted births it is not observed that the child is more developed, or of larger size, than at the usual period. In one of the longest cases of protracted gestation on record (324 days) the child was not above the average size, although, when Dr. Murphy saw it, six months afterwards, it was unusually large and fat for a child of that age. (Obstetric Report, 1844.) This would lead to the inference, that when the child has reached a certain stage of development it ceases to grow. This view is borne out by the observations of Dr. Rüttel. (Henke, Zeitschrift, 1844, p. 247.) This gentleman has not remarked that the size of the child increases in proportion to the length of the gestation. In protracted human and animal gestation the offspring is not remarkable for size and weight. In both cases robust mothers have had small children, and small mothers strong and sometimes unusually large children.

The following case (*Luscombe* v. *Prettyjohn*, Exeter Summer Ass. 1840) will show how unsettled legal opinions are upon these points; and that disputed questions of gestation are sometimes decided without *medical evidence*, although there are few instances in which it is more urgently required. An action was brought against the defendant, by a farmer, to recover compensation for the loss of his daughter's services. It was alleged that the defendant had seduced her, and that she was delivered of a child of which he was the father. He denied that the child was his, among other reasons, on the ground that it was born two hundred and ninety-nine days, or forty-two weeks and five days after intercourse. No medical evidence was called to show that gestation might be thus far protracted; but the judge, in summing up, made the following observations:—"Upon the evidence it was almost *impossible* that he (the defendant) was the father. Supposing that she (the woman) were right, that would place the birth at nine calendar months three weeks and five days." [The last meeting between the parties was had on the 9th of February, and the child was born on the 5th December, 1838, which is equal to an interval of 299 days.] After adverting to some medical authorities relative to gestation, he said:—"He would rather believe that she had yielded to some other attempt on her chastity, than that so wide a departure from the usual course of nature had taken place!" The jury did not concur in this view, and they returned a verdict for the plaintiff, thereby pronouncing an opinion which is well borne out by medical experience, that the defendant might have been the father of the child, although *forty-two weeks and five days* had elapsed since the last access. (Lancet, Aug. 1840.) Had the verdict been the other way, there would have been fair ground, medically speaking,

for a new trial; for the summing up was undoubtedly made on an entirely mistaken view of medical doctrines. It amounted to this, that the chastity of every married woman who bears a child in the forty-third week of pregnancy after the absence or death of the husband, is to be impeached,—and the legitimacy of her child is to be set aside on bare proof of the fact!

In a well marked instance of gestation from a single intercourse, noticed by Dr. Reid, the interval was 293 days,—only six days earlier than the period here pronounced to be incompatible with legitimacy; and by referring to the cases of Dr. Rigby and Dr. Merriman, it will be seen that the periods of gestation from a single intercourse have varied to a much greater degree than the two here put in comparison. It is very true that a limit must be placed somewhere; but the cases reported by Dr. Murphy (ante, p. 409) prove that gestation is not so limited as it was here assumed to be. This shows the risk to which the decision of such questions is exposed, when medical evidence is not called for on matters so strictly professional. As a contrast to this case, the following, which was tried in the United States, in January term, 1844, is of some interest. (*The Commonwealth* v. *Porter;* Cambria County, Pa.) The facts were somewhat similar. The defendant was indicted for fornication and bastardy. Prosecutrix, aged 23, had intercourse with the defendant on the 24th September, 1842, and with no other person before or subsequently. She was delivered of a child on the 7th August, 1843,—*i. e.* 317 days, or after *forty-five weeks and two days' gestation:* she swore that the defendant was the father of the child. The catamenia ceased about three weeks after intercourse, and they only appeared again slightly about five weeks before the child was born. At this time she had pains, which continued more or less until her delivery. She first knew that she was pregnant three or four weeks after connexion. The defence was, that from the period of time which had elapsed, the defendant could not be the father of the child. He, therefore, merely proved his absence, and that he did not return until after the birth of the child. No evidence was adduced to impeach the character or conduct of the female. It was proved that she had always borne a good reputation, and that she had been seduced by the defendant under promise of marriage. Dr. Rodrigue deposed, that, in a practice of nineteen years, he had attended some hundreds of cases of midwifery; and the longest period of gestation which he had known was *ten months.* He considered the pains described by prosecutrix to have been the commencing pains of labour. The Court charged the jury strongly in favour of the medical testimony of protracted gestation, and they returned a verdict of guilty, thereby finding that the defendant was the father of the child. It transpired that a wife of one of the jurymen had during one pregnancy gone ten months. (Amer. Journ. Med. Sciences, Oct. 1845, p. 338.) Dr. Rodrigue, who reports this trial, states that a case subsequently came to his knowledge, in which gestation continued for a period of 320 days.

It would appear that the question of protracted gestation is frequently raised in the United States under these circumstances. Another case of bastardy (*The Commonwealth* v. *Hooner*) was tried in May, 1846, in which the alleged duration of pregnancy must have been 313 days, or 44 weeks and 5 days. The prosecutrix deposed that she had had intercourse with the defendant on March 23d, 1845, and not subsequently,—a fact established by the evidence; and the child, a large healthy male, was proved to have been born on the 30th January, 1846. Twelve physicians were examined on the trial, and as usual they differed from each other. Some regarded it as *possible,* but not probable, that gestation might be so protracted as to reach 313 days. Various medical works were quoted on the subject. The Court charged the jury that, although *unusual* and *improbable,* this length of gestation was not impossible; and they returned a verdict finding that the defendant was the father of the child. (Dub. Med. Press, Nov. 4th, 1846, 296.) In the case of *Dyson* v. *Dyson* (Vice-Chancellor's Court, Feb. 18, 1852,) it was proved that the husband left his wife in Madeira, in Feb. 1849, that she

returned to England in the August following, and the child whose legitimacy was contested was born on the 8th Jan. 1850. It was contended that this was a case of protracted gestation, and the evidence of several medical men to the effect that gestation might be protracted for 330, or even 336 days, was quoted in support of this view. In this case there was a period of 336 days. The Vice-Chancellor having referred to the Gardner Peerage case, declined to make a decree in favour of the legitimacy of the plaintiff. (Legal Examiner, Feb. 21, 1852, p. 93.)

In extra-uterine pregnancy, the fœtus may be carried for many years. Dr. Craddock relates a case, in which gestation was thus protracted for the long period of twenty-two years. (Phil. Med. Exam. May 1846, 286.)

Mistakes in the mode of computation.—Great mistakes have arisen in the calculation of the period of gestation by the use of the word month—some intending by this, *lunar*, and others *calendar* months. Nine lunar months would be equal to two hundred and fifty-two days, while the average of nine calendar months would be two hundred and seventy days—the latter period varying according to the particular months of the year over which the pregnancy may extend. To prevent such mistakes, or that misunderstanding of evidence which has so frequently arisen, it would be advisable that medical witnesses should always express the period of gestation in weeks or days. It would be also proper to adopt the plan of always commencing the calculation from the period of the last cessation of the catamenia, rather than from two weeks later. The latter rule is often followed, and this discrepancy creates confusion.

It will be seen by the foregoing cases and remarks, that in these suits of contested legitimacy the general practice consists in establishing possibility of access on the part of the husband:—when this is proved, the medical question arises, whether the term of gestation falls within those limits assigned by the best medical experience. Legitimacy has been allowed where gestation was probably protracted to the *forty-third week* (*Anderton* v. *Gibbs*, p. 412;) and in the United States, where it extended to *forty-five weeks* and two days, (*Commonwealth* v. *Porter*, p. 415.) It has been disallowed in the English Courts, although probably on non-medical grounds, where it was protracted to *forty-four weeks* and three days (*Gardner Peerage case*, p. 412;) and in one case because it had extended to forty-two weeks and five days (p. 414.)

Cases in reference to proof of access.—In the case of *Cope* v. *Cope* (North. Spring Circ. 1833) an action was brought by the plaintiff, for his share of a legacy, to a part of which he declared himself entitled, as being the son of the deceased testator's brother. There was no doubt that the plaintiff was born during lawful wedlock; but it was contended that he was an illegitimate child:—therefore it remained with the defendants to establish his illegitimacy by evidence. The defendants rested their case, 1st, on the entry in the parish register, which represented the plaintiff to be an illegitimate child; 2dly, on *non-access* between the husband and wife. The husband, having separated from the wife, went to reside at about fourteen miles distance from her. He was absent for several years; but it was contended that he was always within a short distance of the wife. During his absence, the wife formed an illicit connexion with another man, and at this time the plaintiff was born: but it was rendered probable that the husband had visited the wife before and after the birth of the child. It appears that both the mother and her husband regarded this child as illegitimate; and an attempt was made, on the part of the defendant's counsel, to put in declarations to that effect; but the Court interposed; and Alderson, B. said —"Lord Hardwicke had decided that the mother could not be allowed to give evidence on such a point, as she could not discharge the husband of the birth of the child; and *à fortiori* the husband could not be permitted to discharge himself. Lord Mansfield and Lord Hardwicke had both decided that illegitimacy could only be proved by the fact of there being no marriage, or by the proof of non-access: and it was held, on the grounds of decency and morality, that the parties

themselves should not be allowed to prove non-access after their marriage." In summing up, he further observed, "that if a child be born in marriage during the life-time of the husband, that child in law is presumed legitimate. The plaintiff in this case is the youngest child, and was born after four other children, and during the lifetime of the reputed father; and he is in law, therefore, legitimate, unless the fact were proved, which it was for the jury to decide upon, viz. that the husband had not opportunities of access. If a husband have access, and others at the same time have criminal intimacy with his wife, still a child born in such a case is legitimate in the eye of the law. But if the parties are living separate, and the wife is notoriously living in open adultery, and the husband have opportunities of access, yet under such circumstances, it would be monstrous to suppose that he would avail himself of these,—then the legitimacy of a child, so born, could not be established." The jury returned a verdict for the plaintiff, finding that he was legitimate.

From this case we learn what kind of evidence the law requires in order to establish access or non-access. In order to defeat the legal presumption of access, where husband and wife are living near to each other, something more than mere probability of non-intercourse must be adduced. It is true, that in this case, the wife, while separated from her husband, was living in open adultery—but non-access of the husband was far from being clearly established. On the contrary, access was rendered probable by evidence:—therefore a verdict was returned, finding the plaintiff legitimate. It will be seen that very little value is set on baptismal registries, as evidence of legitimacy, or the contrary; also that the declaration of a parent will not be received by a Court as evidence of the illegitimacy of the reputed offspring.

The case of *Morris* v. *Davis*, which came before the Lord Chancellor in 1830, is also of interest. This was a suit of contested legitimacy, which had been pending for eighteen years before the Courts; and which was finally left by both parties to be disposed of by the judgment of his lordship, on the facts and on the law of the case. The plaintiff was the son of a Mrs. Morris, and claimed to be the son of Mr. Morris; but it was contended that, although born in wedlock, he was illegitimate. The husband and wife had voluntarily separated; but lived for many years within a short distance of each other. The wife was living with an adulterer; and fourteen years after the separation, this child, the plaintiff, was born. The wife saw her husband occasionally, but concealed the birth of the child from him. The man with whom she was living considered it, and always treated it, as his own; and Mr. Morris remained for seventeen years in ignorance of the birth or even of the existence of the child. His lordship having stated the law of the case, as already given, said the question was one of fact and not of law. There was an apparent difficulty in the case, owing to this,—that the parties, although separated, were proved to have met occasionally:—there was, therefore, unquestionably opportunity of access:—but it so happened, that *none of these meetings would correspond with the time requisite for the birth of the child* to render it legitimate. This fact, together with the general bad conduct of the mother, and her open adulterous intercourse, led him to pronounce that the plaintiff was an illegitimate child; and that he was not the son of Mr. Morris. This judgment was not opposed to the rule of law, nor was it founded upon a mere balance of probabilities, but entirely upon the facts of the case.

PATERNITY.

CHAPTER LIII.

DISPUTED PATERNITY—EVIDENCE FROM LIKENESS—DOUGLAS PEERAGE CASE—PARENTAL LIKENESS—AFFILIATION.—POSTHUMOUS CHILDREN.—SUPERFŒTATION IN RELATION TO LEGITIMACY—CIRCUMSTANCES UNDER WHICH IT IS SUPPOSED TO OCCUR—SUPERCONCEPTION.—SUPPOSITITIOUS CHILDREN—RELATION OF THE SUBJECT TO FEIGNED DELIVERY AND LEGITIMACY.

Disputed paternity.—It has been stated that the law does not pretend to determine who begat a child when it has been born during wedlock, and from circumstances might be the child either of the husband or an adulterer. But medical jurists have recommended that family likeness should be looked to on these occasions,—not merely a likeness in *feature* and figure, but in *gesture* and *other personal peculiarities* which may have characterised the alleged parent. These are called questions of *paternity:* they seldom occur, and when they do present themselves, the evidence thus procured, even if affirmative, is properly regarded as only corroborative. In the *Townshend Peerage* case, brought before the House of Lords in May, 1843, this argument of family likeness was used and admitted by their lordships. The party whose legitimacy was in question was sworn by one of the witnesses to bear so strong a likeness as a child to the alleged adulterer, that he should have known him among five hundred children. The proceedings in the *Douglas Peerage case* (1769) also show that evidence of this kind is of some importance. This peerage was claimed on appeal to the House of Lords by the survivor of two brothers, Archibald Douglas, after the death of the alleged parents, Sir John and Lady Douglas. The claim was disputed, on the ground that the appellant and his deceased brother were supposititious children. Much stress was laid in favour of their legitimacy, on the fact that they closely resembled—the one Sir John, and the other Lady Douglas. The resemblance was general,—it was evident both in their features, gestures, and habits. Lord Mansfield, in delivering judgment, made the following judicious remarks, which comprise all that can be said on the subject. "I have always considered likeness as an argument of a child being the son of a parent, and the rather as the distinction between individuals in the human species is more discernible than between other animals. A man may survey ten thousand people before he sees two faces exactly alike, and in an army of a hundred thousand men, every man may be known from another. If there should be a likeness of feature, there may be a difference in the voice, gesture, or other characters; whereas a family likeness runs generally through all of these; for in every thing there is a resemblance, as of feature, voice, attitude, and action." From this account, it will be seen that evidence from family likeness is not strictly medico-legal,—it can be furnished only by friends and relatives who have known the parties well, and are competent to speak of the facts from personal acquaintance with them. It will also be apparent that the affirmative evidence in such cases will be stronger than

that which is negative; for it could hardly be inferred that a person was illegitimate, because he did not resemble his parent.

Parental likeness.—Parental likeness may be occasionally indicated by colour or peculiarities belonging to the varieties of mankind, as of the intermixture of the Negro with one of the Caucasian variety. In such a case the evidence afforded becomes much stronger; and supposing that two men of different varieties have intercourse about the same time with the same female, the colour of the skin may enable a Court to determine the question of paternity. It is said to have happened, on more than one occasion, that a black woman has given birth at one time to a black child and a mulatto; and Dr. Cunningham refers to a case in which a negress recently gave birth to twins, one a black and the other a white child. (Lancet, May 9, 1846, 525.) This was probably a case of superconception.

Personal *deformities* are not necessarily transmitted from parent to child; yet it would appear, from the subjoined case, that a disputed question of affiliation has been settled on this principle. A woman alleged that a gentleman in whose service she had lived, was the father of a child of which she had been recently delivered. The solicitor who appeared to support the affiliation rested his case chiefly on the fact that the child had been born with five fingers and a thumb on the right hand, the defendant himself having been born with a similar malformation on both of his hands. It was argued on the other side, that the deformity might have arisen from the mother's imagination, as, while pregnant, she was constantly in the habit of seeing the defendant. The magistrates decided that he was the father of the child, and condemned him to pay the necessary expenses for its support. (Med. Times, March 6, 1847, p. 47.) It is very likely that the decision was here influenced by moral circumstances; for otherwise the defendant might have been the victim of a coincidence. Six-fingered children are, it is well known, born occasionally of five-fingered parents; and as the deformity existed only on one hand in the child, while it was on both hands in the parent, the medical proof that it was actually transmitted by generation was certainly not clearly made out. In some instances attempts have been made to fix the paternity of a child by the *colour of the hair*, but this evidence is far less conclusive than that afforded by the colour of the skin. In the case of *Frazer* v. *Bagley* (Feb., 1844,) the wife of the plaintiff was alleged to have had criminal intercourse with the defendant, and the last two children were alleged to be the offspring of the latter. The plaintiff and his wife had dark hair, as well as all the children with the exception of the last two:—these had red hair, and it was further proved that defendant had red whiskers and sandy hair. No particular stress was laid upon this evidence, but it was received as a kind of indirect proof. But little confidence can be placed on facts of this description, since red-haired children are often born to parents who have dark hair; and in one case the children born in wedlock were observed to have dark and red hair alternately.

Affiliation.—Questions of paternity are involved in those relating to *affiliation*. A party may allege that he is not the father of a particular child, by reason of certain circumstances upon which a medical opinion may be required. The necessary transmission of gonorrhœa or syphilis by intercourse, may thus become a medical question. In September, 1844, a man was required, under the law of bastardy, to support two children alleged by a female to be his. The time of gestation was within nine months. The accused denied that he had had intercourse with the deceased, or that he could have been the father, since he was at the time under medical treatment for the venereal disease. The medical questions may therefore assume this shape:—1. Are these diseases invariably transmitted by intercourse?—2. Do they interfere with the act of procreation? Under common circumstances they must both be answered in the negative.

A singular case of bastardy is reported to have occurred in the Canton of Appenzell. The question was, which of two persons, who had had intercourse with

the same woman within a period of *seventeen* days, was the father of the illegitimate child borne by the woman. The Council, to which the case was referred, gravely resolved to postpone their decision until the features of the child were so far developed as to enable them to decide from *paternal likeness*. The equity of this difficult case would have been met by compelling each man to contribute to the support of the child! (Schneider's Annalen der Staatsarzneikunde, 1836, 1 B. s. 470.) The following, which is a more doubtful case, was the subject of a communication to the Lancet (March 13, 1847, 263.) Two men, A. and B., had intercourse, unknown to each other, with a young woman of delicate health; and after this had continued for some years, she was delivered of a female child, nine calendar months and three days after sexual intercourse with A., and nine calendar months, less five days, after similar intercourse with B.; or at the end of 279 days after intercourse with A., and at the end of 271 days after intercourse with B.; that is, a period of *eight days* elapsed between the periods of intercourse of the two men, and the woman had no menstrual discharge in the mean time, and it is not believed she knew any other man. She went her full time, had a good labour, and produced a fine healthy girl; had a plentiful supply of milk, and enjoyed better health during her pregnancy and suckling than at any other time. The woman died, and the circumstances of this mixed intercourse having become known to A. and B., they both refused to maintain the child. A. contended, that as the woman was not delivered until nine months and three days after connexion with him, it was physically impossible that the child could be his. B. contended, on the other hand, that 280 days, and not nine months, is the period of gestation; and that the child having been born 279 days after connexion with A., and only 271 days after connexion with B., it was therefore probable that the child was begotten by A. There was no perceptible likeness of either of the men in the child, but a marked likeness of the mother.

It is obvious, from the remarks elsewhere made (ante, p. 415,) that the two periods, 271 and 279 days, are comprised within the common range of gestation: hence there would be no *medical* ground for affiliating the child to one more than the other. As in the former case, justice to the offspring and to each possible father requires that they should be both bound to support the child. These questions of affiliation, when the interval is less than six or eight weeks, can rarely be determined by medical evidence. In a twin case, it would be only just that one child should be affiliated to each individual. In a recent case of affiliation, an attempt was made to set aside the order of a magistrate fixing the paternity on the putative father, on the ground that, as the intercourse was had, and the child conceived in France, although born in England, it was removed from the jurisdiction of an English magistrate, and should be left to the French Courts. The objection was overruled, and the alleged father was ordered to pay the usual sum for maintenance.

Posthumous children.—It has been supposed, that a case involving a question of paternity might present itself on the marriage of a widow soon after the death of her first husband. If a child were born after the lapse of ten months, it might be a question whether it was a child of the first or second marriage—of the dead or the living husband; and although there might be no dispute concerning its legitimacy, yet it would be difficult to settle its *paternity*. Such a case appears hypothetical. In order that any doubt should exist, a woman must marry within, at the furthest, *six weeks* after the death of her first husband, or else the birth of the child would fall beyond the furthest limit of gestation, so far as he was concerned. The customs of society are, however, a bar to such marriages; and admitting that a child was so born, that it might be the offspring of either husband, then the fact of its having been born during the marriage of the second husband, would presumptively fix the offspring upon him, unless it could be shown that there was no possibility of access on his part. If there were a supposed greater likeness to the first than the second husband, still this

would not be allowed to defeat the legal presumption of the real parentage of the child. It appears to me, that evidence much stronger than this would be required for such a purpose. (See Henke, Zeitschrift, 1838; ii. 432.)

SUPERFŒTATION.

Superfœtation in relation to legitimacy.—Most medico-legal writers, in treating of legitimacy, have considered it necessary to introduce the subject of superfœtation. By this we are to understand, that a second conception may follow the first, and that gestation may go on to its full period in each case, independently of the other,—so that if a woman were impregnated, when in the third month of gestation, she would bear the first child mature at the end of nine months, and the second child, also mature, at the end of twelve months after the first conception. This subject has been said to involve "not only the conjugal fidelity of a wife, but the disposition of property, and much of the comfort and happiness of society." Its importance to a medical jurist appears to me to have been considerably exaggerated. So far as I have been able to ascertain, not only is there no legal case involving this question, to be met with in the judicial records of this country, but none, in reference to this state, is ever likely to occur which would present the least difficulty to a medical practitioner. If we admit that a woman may, during marriage, present such an extraordinary deviation from the common course of nature, as to produce two perfectly mature and fully developed children, the one three or four months after the other, how can such an event be any imputation on her fidelity? Superfœtation, if it occur at all, may occur in married life, and during connubial intercourse. The following appears to be the only possible case wherein a medical opinion might be required respecting this alleged phenomenon. A married woman, six months after the absence or death of her first husband, gives birth to an apparently mature child, which dies. Three months afterwards, and nine months after the absence or death of her husband, she may allege that she has given birth to another child, also mature: a medical question may arise, whether two mature children could be so born, that the birth of one should follow three months after the birth of the other,—or whether this might not be a case, by no means uncommon, of twin children, the one being born prematurely, and the other at the full period. (For a case of this kind, at two months' interval, see Med. Gaz. xxxvii. 27; and for another at eight days' interval, see the same journal, vol. xlvii. p. 227.) Admitting that both the children were mature, and therefore that it was a case of superfœtation, the first delivery must have taken place in the presence of witnesses, and it would then have been known whether another child remained in the uterus or not. If the two children were born within the common period of gestation after the absence or death of the husband, then their legitimacy would be presumed, until the fact of non-access were clearly established. The mere circumstance of their being apparently mature, and born at different periods, would *per se* furnish no evidence of their illegitimacy. On the other hand, if one or both of them were born out of the ordinary period, then, according to the evidence given, they might or might not be pronounced illegitimate. The law therefore appears to have no sort of cognizance of the subject of superfœtation as such; it is entirely merged in the question of protracted gestation, which has already been fully considered.

Super-conception.—Whether superfœtation can really take place or not, is a question which has given rise to much controversy. That one conception may follow another within a short period, and that twins may thus be the result of two distinct conceptions, is a probable occurrence. This, indeed, is what may be termed *super-conception*. But when gestation has already gone to the second month, it is highly improbable that there should be a second conception. In two cases, however, in which two men had intercourse with the same female within the period of seventeen and eight days respectively—cases favourable to

super-conception,—there was, in each case, only one child, and the p... was actually disputed. (See ante, p. 420.) It would appear, from the re... of Douné, that there is a limit to this power of super-conception. He ha... that the mucus secreted from the vagina of pregnant females is, by reas... its great acidity, completely destructive of the existence of the zoosperm... therefore renders the spermatic fluid unprolific. (See post, STERILITY.) ... does not appear, however, that the vaginal mucus becomes more acid a... period; but, according to Mr. Whitehead, the effect is due to this acid se... not being partially neutralized, as in the unimpregnated state, by the al... mucous secretion of the uterus. (On Abortion, 406.) At what period of p... nancy the vaginal mucus begins to act destructively on the zoosperms, ha... yet been determined; but further researches may show that we have in ... chemico-physiological effect a complete answer to the doctrine of superfœ...

Cases of alleged superfœtation appear readily explicable on the supp... that the woman was pregnant with twins, and that one was born prem... and the other at the full time, or later. The following case, reported by ... Möbus, of Dieburg, (Henke's Zeitschrift der S. A. 1837,) will serve to illu... this subject:—A healthy *married* woman, about thirty-five years of age, ... safely delivered of a girl, on the 16th of October, 1833. The child is des... as having been well formed, and having borne about it all the signs of matu... This woman, it is to be observed, had previously had several children in a reg... manner. Soon after her delivery and the expulsion of the placenta, she fel... on this occasion, something still moving within her. On examination, the ... uteri was found completely contracted, and the organ itself so drawn up as ... render it difficult to be reached; but the motions of a second child were ... plainly distinguishable through the parietes of the distended abdomen. Her ... livery was not followed by the appearance of lochia or by the secretion of mil... The breasts remained flaccid, and there was no fever. On the 18th of Novem... *thirty-three days* after her first confinement, this woman, while alone and unass... was suddenly delivered of another girl, which, according to Dr. Möbus, w... healthy, and bore no signs of *over-maturity* about it. The reporter alleges th... this case most unequivocally establishes the doctrine of superfœtation. The ... births took place at an interval of *thirty-three* days, and the two children w... it is stated, when born, equally well formed and mature: but Dr. Möbus did n... see the second child until twenty-four hours after birth.

This appears to have been nothing more than a twin case, in which one ch... was born before the other. Dr. Möbus considers that the first child was bo... at the usual period of gestation, it being described as mature; and the oth... thirty-three days after that period,—having been, in his view, conceived so ma... days later than the first child. If, however, we imagine that in this, as is often happens in twin cases, one twin was more developed than the other, and th... the most developed was the first expelled; or that it is not always easy to com... pare the degree of development in two children, when one is born before the other, and they are not seen together, we shall have an explanation of the fact without resorting to the hypothesis of two distinct conceptions. As to the sign of *over-maturity*, alluded to, they are not met with. If we are to believe authentic reports, a child born at the thirty-ninth week is not to be distinguished from one born at the forty-third or forty-fourth (ante, p. 414;) and children born at the full period vary much in size and weight. A longer period may be required to bring the child to maturity in some women than in others; and in a woman with twins, it is well known that the two children may arrive at the same degree of maturity within different periods,—one requiring, perhaps, several weeks longer than the other for its full development.

Cases of abortion of one twin, the other remaining in utero, are by no means uncommon. Two cases of this kind are referred to in the Ed. Med. and Surg. Journal. (July, 1839, p. 289.) In one, abortion took place at three months

while the woman went to her full time and was delivered of a healthy child at nine months. In the second, one fœtus was expelled at about four and a half months, while four months afterwards, a full-grown child was born. Even under a malformation which might be supposed to be favourable to its occurrence, namely, the presence of a bilocular uterus, it has been found that impregnation has taken place in one cornu only. (See Med. Gaz. xix. 507.) A singular instance is however recorded in the same journal (xx. 508,) where a woman, six months after marriage, bore a four months' child, and forty weeks after marriage, mature twins. On examination, the uterus and vagina were both found double, and each vagina had a separate orifice. Dr. Horlbeck, U. S., states that he met with a case in which a well grown fœtus of six months was simultaneously expelled with an embryo about six weeks old! (Med. Gaz. xliv. p. 87.) In a late number of the Medical Times, Dr. Foley has published the account of a case in which the mole was expelled from the uterus at an early period of pregnancy, while the female was delivered about the usual period of a living and well formed, although weakly child, which survived its birth three days (Jan. 31, 1852, p. 104.) [See a paper by Dr. Lopez, in Am. Jour. Med. Sci. Oct. 1846, for numerous cases of apparent superfœtation; also a case by Dr. Carter, in the Phil. Med. Ex. 1849, 523.—H.]

Monstrosity and Superfœtation.—A most extraordinary case of monstrosity, involving the questions of superfœtation and paternity, is stated to have occurred at Alexandria in Egypt. A Fellah woman was delivered of a dicephalous monster, of which one head was *white*, and apparently about the eighth month of uterine life, while the other head was *black*, possessing in other respects the negro conformation, and this head was fully developed. The monster was born dead; and the mother died soon after her delivery. The change in the colour of the skin commenced at the neck of the black head, and was found by M. Prus, an eminent sanitary physician at the port of Alexandria, to be due to the existence of a colouring matter similar to that found in the skin of the Negro race. The husband of the woman was a Fellah, whose skin was of a brownish colour. There were Negro labourers in the port, but it could not be ascertained whether the woman had had intercourse with any of them. It is therefore impossible to say whether this was or was not a case of impregnation about the same time by two men of different races. Admitting that this occurred, it is difficult to understand why the black colour should have been confined to the head only. (See L'Union Médicale, 5 Août, 1848.)

SUPPOSITITIOUS CHILDREN.

Another medico-legal case in relation to legitimacy, occurs where a woman feigns delivery, and represents the child of another person to be her offspring:—or she may substitute the living child of another woman for a dead child of which she herself has been delivered; or for a mole or hydatids which may have passed from her. So again, a male may be substituted for a female child, and vice versâ. The practising of a fraud of this nature may seriously affect the rights of inheritance of parties; but it cannot be accomplished without great dexterity and cunning, or without the co-operation of several accomplices. Frauds of this kind have, in general, been committed by the aid of a low class of midwives. One instance occurred at Chelsea, in July, 1842, where the fraud was brought to light by the death of the supposititious child. The calling in of a professional man would infallibly lead to discovery, when the question was simply whether delivery had or had not taken place; but if it be alleged that one living child has been substituted for another, the proof of this can depend on medical evidence only when the age of the supposititious child does not happen to correspond to the pretended delivery. (See Ann. d'Hyg. 1829, ii. 227.) The legitimacy of the claimant of the Douglass peerage was disputed on this ground, but apparently without foundation (ante, p. 418.) A remarkable case of this de-

scription will be found in Henke's Zeitschrift der S. A. 1845, ii. 172; and a trial has recently taken place in England, involving the alleged substitution of a child, but requiring no medical evidence for its elucidation. (*Day* v. *Day*, Leicester Lent Ass. 1845.)

The manner in which an imposition of this kind may be carried out is well shown by a case which occurred recently in France. The female was, in this instance, a deaf and dumb woman, married; and it appeared that the husband was in collusion with her. It was not in her power to make any disposition of some property to which the children of her marriage would be entitled, and by the advice of her husband she simulated pregnancy in order to deprive the heir-at-law of the property, to which he would be entitled at her death. The facts, as far as they could be ascertained, were as follow:—The woman was forty-two years of age, and although married for a period of twenty years, had borne no children. On this occasion, admitting her statement to be true, she was delivered without any medical assistance. All her acquaintances and friends were ready to depose, that for six months she had presented the usual appearances of real pregnancy, and that she had manifested the usual indisposition attending pregnancy, including occasional faintings at the parish church! For the heir-at-law it was contended, that she had substituted, for her false accouchement, the child of a person named *Peyrins*, born only a few days before; and that she had made a false declaration of the birth. A midwife was ready to depose that the deaf and dumb woman had never been a mother. The decision in this singular case is not stated. (Ann. d'Hyg. 1847, i. 463.) It is obvious that it can only be by the accident of the simultaneous delivery of another female in secrecy (whose pregnancy is unsuspected,) that a trick of this kind can be successfully practised.

A case involving this question (*Hutchins* v. *Hutchins*) was heard in the Vice-Chancellor's Court in May, 1851. The amount of ingenuity required to perpetrate a fraud of this kind was only equalled by the skill with which the facts were exposed, and justice was ultimately done to a rightful claimant.

HERMAPHRODITISM.

CHAPTER LIV.

SEXUAL MALFORMATION—HERMAPHRODITISM—ANDROGYNUS—ANDROGYNA—DISTINCTION OF SEX—MISTAKES IN THE SEX OF CHILDREN—RULES FOR DIAGNOSIS—CASES.—CAUSES OF SEXUAL DEFORMITY IN THE FŒTUS—LEGAL RELATIONS—CASES IN WHICH THE DETERMINATION OF THE SEX IS NECESSARY.—IMPUTATION OF HERMAPHRODITISM—THE RIGHTS OF ELECTORS DEPENDENT ON A NORMAL CONDITION OF THE SEXUAL ORGANS.—CONCEALED SEX.

General remarks.—The legitimacy of a child is open to be contested under other circumstances than those connected with the duration of gestation. The alleged parent may have laboured under *physical incapacity;* if a male, he may have been affected with impotency; if a female, with sterility; and if either of these conditions be proved, the illegitimacy of the child will be established, although the alleged period of gestation may be comprised within the ordinary limits. The sexual conditions now about to be considered have also an important bearing in relation to divorce, and occasionally to the civil rights of the child who may be the subject of the malformation. One of the most common and obvious causes of impotency or sterility is malformation of the sexual organs, to which species of monstrosity the term *hermaphroditism* is commonly applied.

SEXUAL MALFORMATION.

Owing to arrested development, during the growth of the fœtus, the sexual organs, which can scarcely be distinguished in the fœtus at the fourth month, occasionally assume an abnormal arrangement. These organs appear to be at that time more or less mixed; and sometimes the male, and at others the female characters predominate. In the former case, these beings are called androgyni, and in the latter androgynæ. With this defective sexual development, the other peculiarities of the sexes are either wanting, or we find them more or less blended. When, therefore, the being is a male with malformation of the genetative organs, it is called *androgynus*—when a female with a like malformation, *androgyna.* There can be no difficulty in identifying such cases, and, according to the degree of malformation, a medical jurist can have no hesitation in pronouncing these subjects to be incurably impotent. The organs are commonly so defective as to be wholly unfitted for the functions of either sex. It is not meant to be said, that it is in all cases easy to assign the *sex,* but this is of minor importance; the main question is, whether the malformation be or be not such as to justify divorce, or the imputation of illegitimacy upon children claiming to be the offspring of these beings.

Distinction of sex.—The determination of the *sex* in these cases of *deformity* has been considered to be necessary under certain circumstances; as when, for instance, a title or entailed inheritance of lands is in question. Lord Coke has stated, that according to the law of England, a hermaphrodite may be either male or female, and it shall succeed according to the kind of sex which doth prevail. Thus, it is obvious that the law will decide each case according to the special circumstances attending it: but it must not be supposed that the decision is so easy as Lord Coke's doctrine would imply. There are many cases in which

neither sex can be said to prevail. The beings are positively neuter. The great character of the male would consist in the presence of testicles, and of the female in the presence of a uterus and ovaries. In a case which occurred to Mr. Grigor, both the testicles and ovaries were wanting: there was no essential character of either sex, and even during life it would have been impossible to say whether this being was male or female. (Cormack's Monthly Journal, July, 1845, 492.) In the same journal (page 531) is reported another case, where, notwithstanding the *external* resemblance to a female, the presence of one testicle in a scrotum showed that this individual was of the male sex. Yet this person passed for a woman until he had reached his 26th year! It is rare that there is external malformation without internal defect, and even where the female character preponderates in the person, it is not improbable that the uterus or the ovaries may be absent, or the former may be malformed. Such beings are not known to menstruate, and even if there be capacity for intercourse, they are permanently sterile. Sexual desires are, however, commonly absent.

When the subject is young, mistakes respecting the sex are more common than when it is advanced in life. So soon as the period of puberty is past, certain changes take place in the configuration of the body, which may aid the medical practitioner in forming an opinion. Thus a grave tone of voice, the presence of a beard, the width of the shoulders, and narrowness of the pelvis, will indicate cæteris paribus the male sex: while, when these conditions are absent, and there is a rotundity of the members, with want of prominence in the muscles, and a development of the mammæ, we may pronounce upon the female sex predominating. Although no testicles be apparent, still the being may be of the male sex, since it is well known that in persons otherwise well formed these organs occasionally do not descend to occupy the scrotum. Dr. Harris, of Clarkesville, has related a very singular case, in which, although no testicles could be found, there was a short but naturally formed penis, through which the being regularly menstruated! The female character predominated in the corporeal development, and there was the rudiment of a vagina. (Med. Gaz. xl. 562.) The fact that the being menstruated, was here sufficient to assign it to the female sex. How easily mistakes may be made in the sex of young children is shown by a case which occurred to Mr. Terry, and is quoted in Cormack's Journal, April, 1845, p. 307. The child was christened as a female, and so considered by the parents for two months, when, owing to some defect in the passage of the urine, it was brought to Mr. Terry, and he found that there was malformation of the penis—no vagina, a scrotum, with one testicle down and the other descending. He therefore pronounced it to be a male, and its costume was altered accordingly. The presence of a beard and whiskers is usually considered to characterize a male, but the growth of hair on the chin and face is sometimes more profuse in females than in the generality of males. Dr. Chowne had lately to examine a female named Josephine Boisdechine on behalf of a man who was about to marry her, but who required a certificate as to the real sex of his intended wife! Dr. Chowne examined the woman, and found nothing in her external conformation indicative of doubtful sex. The breasts were large and full, and the only resemblance to a male was in an abundant beard and very profuse whiskers. The upper lip was free from hair. (See Lancet, Oct. 11, 1851, p. 335.)

This case has been published in full by Dr. Chowne, in the Lancet for May 1, 1852, page 421. He has appended an engraving which displays a profuse beard and whiskers. It is stated that this female was born with a quantity of hair on her chin, and that at eight years of age the beard was two inches long!

In some cases an external examination will entirely fail in indicating the sex, and even the opportunity of a post-mortem examination may leave the case in doubt. An ingenious writer has laid it down that there are analogous organs in the two sexes which are never found in the same subject, and the separate existence of which would enable us to determine the sex. These analogous parts

are the penis and the clitoris—the scrotum and the labia—the testicles and the ovaries—the prostate gland and the uterus. This, however, is an artificial, and, as facts show, an incorrect means of diagnosis. If a penis could always be clearly distinguished from a clitoris, and a scrotum from the labia, the rule might be serviceable; but it fails where it is most required, *i. e.* in the mixed conditions. As to the other means of diagnosis, even if correct, they will only enable an examiner to distinguish sex in the dead, whereas it is during the *life* of the being that the law requires the aid of medical science in the solution of these questions. The reader will find, in the Medical Times and Gazette, an account of some remarkable cases of sexual malformation by Mr. Curling (Jan. 24, 1852, p. 84;) by Mr. Fletcher (Feb. 7, 1852, p. 136;) and by Mr. Brodhurst (Feb. 21, 1852, page 187.)

Mixed cases.—A case has been already mentioned in which neither testicles nor ovaries were found after death, and more than one has occurred where both have been found,—a case of intermixture of the sexes, or real hermaphroditism, physically speaking, but of course without the power of self-impregnation. The following case is mentioned by Briand:—The subject was about eighteen years of age when he died. The body was partly that of a male in configuration, and partly that of a female. An examination of the sexual organs, externally, led to no satisfactory diagnosis;—and on a post-mortem inspection, a testicle was found in what was supposed to be the left labium, with an epididymis and spermatic cord attached to it as usual; while on the other side were an ovary, Fallopian tube, and the rudiments of a uterus. The authenticity of this case was for some time a matter of dispute: but another, equally singular in its features, occurred to Prof. Mayer of Bonn. This case clearly shows that such extraordinary deviations may be met with in nature. The person examined by Mayer died in 1835, at the age of 55. Different opinions had been formed during his lifetime respecting his sex by the first anatomists in Europe, some affirming that it was a male, while others contended that it was a female. This difference of opinion is sufficient to prove that an *external* examination does not always enable even a good anatomist to pronounce an opinion of the probable sex of the being. In his body was found, on the right side, a withered testicle, with a penis and prostate gland, as male peculiarities:—while on the left side was an ovarium, with a uterus, vagina, and Fallopian tube. (Med. Gaz. xix. p. 135.) It should be stated, that the general configuration of the body in this case was that of a female; but there was a duality of sex.

Causes.—The causes of this singular malformation of the sexual organs, like all other kinds of monstrosity, are involved in mystery. We know that in the early part of utero-gestation the sex of the fœtus cannot be distinguished; while, even when it has reached the fourth month, the genital organs are so similar that the sex can seldom be determined on inspection. Some organs of the body appear to be formed by equal and symmetrical portions, which gradually approximate and unite in the median line of the body. We observe this mode of union in the bones of the cranium, sternum, and spine, as also in the various fissures or raphes of the skin, which are the remains of a union between two equal and symmetrical parts of an organ, now become one. In regard to defects in organization, it may be remarked, that they almost invariably occur in or about some part of the median line; and they appear to proceed from a mere arrest of growth or development in those particular parts, either on one side or both, during the early stage of uterine existence. In this respect, the fissures sometimes observed in the palatine bones, in the palate itself, or in the lip,—the openings occasionally noticed in the sternum, diaphragm, anterior parietes of the bladder, as well as in the vertebral canal, are precisely analogous in origin to the defective development of the sexual organs. There is nothing absolutely removed or lost, but there is an arrest of development; an opening, or fissure, which nature intended to be only temporary, becomes permanent through an arrest of growth. In the

evolution of the male genital organs, the part corresponding to the scrotum is at first always divided by a considerable fissure; and the penis and the clitoris having, at this period of life, much the same kind of physical exterior, the sexual organs cannot be well defined. Should this fissure in the male not be filled up afterwards, then we shall have the most common variety of sexual malformation, —the hermaphroditic form, with the male predominating. These observations are not of course applicable to those cases in which the sexes are positively mixed. In these instances there appears to be a separate sexual organization on the two sides of the body, with an imperfect development of each set of sexual organs. According to Weber, there is in the prostate gland a rudimentary uterus in every male. (Baly and Kirkes' Recent Advances in Physiology, 1848, 112.) (For some interesting observations on this subject, by Dr. Knox, see Med. Gaz., Nov. and Dec. 1848.)

One circumstance is worthy of note, namely, that sexual monstrosity appears occasionally to occur in the successive pregnancies of a well formed female. My colleague, Dr. Lever, met with a singular instance of this in a female aged 28. She had given birth to four children in three confinements, the first being a twin labour; both the children males; and in both there was an arrest of development of the sexual organs. On the third delivery the child was a male, and its sexual organs presented the same deformity as those of the twins. (Med. Gaz. xxxviii. 946.)

Legal relations.—These beings, owing to defective development, are impotent and sterile. Questions connected with the legitimacy of offspring and divorce may, therefore, be raised with respect to them. This part of the subject will be considered hereafter. Sexual monstrosity is not a ground for depriving a being of the rights of inheritance except under peculiar legal conditions. Thus, a right of succession or inheritance to landed estate may depend upon the *sex* of the offspring,—as where, for instance, two children are born, the first a hermaphrodite, the second a well formed male child. The parents die, and a title of nobility or lands may fall to the first-born male. Here the sex of the first-born must be determined before possession can be had. In a case of this kind, if medical evidence should establish that male peculiarities predominated in the first-born, the second child would be cut off. Again, if an estate were limited by entailment, as where it is settled upon heirs, male or female, of a particular family, the birth of a hermaphrodite, an only child, would create the legal necessity for a positive determination of the predominance of sex. So, if the hermaphrodite live but a few minutes after birth, and then die, the rights of persons may be subsequently much affected by the medical attendant having come to an opinion respecting its sex. Since we cannot determine under what circumstances litigation may ensue, it is always right in a doubtful case to observe the sex, and make notes on the spot, when a child thus malformed survives its birth but for a short period. The question of tenancy by courtesy, or the right of the father to landed estate of which the wife was seized, will depend entirely upon the attention of the accoucheur to this point. (See *Tenancy by Courtesy*, ante, page 391.)

When these beings have reached the adult age, other questions may arise with respect to them. According to an old law of France, a hermaphrodite was permitted to choose one sex, and thereafter compelled to keep it! Hermaphrodites, or sexual monsters, were formerly ranked with infamous persons; and it has been a serious question in our courts, whether the calling a man a hermaphrodite was not such a libel or slander upon him as to render it a ground for a civil action. In a case reported by Chitty (Med. Jur. 374,) the use of this term was held not to be actionable unless it was proved that it had been attended with actual damage. A dancing-master brought an action against a party for calling him a hermaphrodite, and it was decided that it was not sustainable:—1. Because such a union of the sexes cannot exist in fact, and every one must be sup-

posed to know it; consequently the assertion could not be supposed to prejudice. 2. Because, admitting the possibility of such a double function, the party would be just as good, and perhaps even a safer dancing-master, than if only one perfect sex had been discoverable, consequently the words would not, in legal presumption, injure him in his profession or occupation!

I am indebted to a learned member of the bar for a note on the case of the *Chevalier d'Eon*. There was a great dispute concerning the sex of the Chevalier, and it came before a Court of Law on an action to recover a wager under the following circumstances (*Da Costa* v. *Jones*, 2d vol. Cowper's Reports, p. 729.) The plaintiff declared that the defendant, on the 4th October, 1771, in consideration that the plaintiff would then pay him seventy-five guineas, undertook to pay to the plaintiff three hundred pounds, in case the Chevalier should at any time prove to be a female. The cause was tried before Lord Mansfield, at Guildhall, and the jury found a verdict for the plaintiff, damages £300, thereby affirming that the Chevalier was a *female*. A motion was subsequently made on behalf of the defendant to arrest the judgment, or at least to stay the proceedings, on the ground that the action could not be supported, as being upon a wager tending to introduce indecent evidence, and also as being one which materially affected the interest of a third person. The question thus raised on the motion was argued before the Court of King's Bench, and the judges unanimously agreed that the judgment must be arrested; the law not allowing wagers upon subjects leading to the introduction of indecent evidence, (this being *contra bonos mores*) or upon such subjects as are calculated to have an injurious effect upon the interests or character of a third person.

Irrespective of this decision, the verdict was based upon what subsequently turned out to be untrue. The Chevalier was really a *male*, and not a female. He was carefully examined by Sir Anthony Carlisle, who satisfied all present of the perfect condition of the testicles. (See Paris and Fonblanque, i. p. 229.)

It would appear from a very singular case, reported by Dr. Barry, that in the United States the rights of citizenship, and the power of voting for members of Congress, have depended on the determination of sex. In March, 1843, he was requested to examine the case of Levi Suydam, aged 23 years, a native of Salisbury, Con. At the exciting and warmly contested election of the spring of that year, almost every thing bearing the semblance of the human form, of the male sex, was brought to the ballot-box. It was at this time, and under these circumstances, that the above-mentioned person was presented by the Whigs to be made a free*man;* he was challenged by the opposite party on the ground that he was more a female than a male, and that, in his physical organization he partook of both sexes.

The following was the result of the first examination:—On exposing his person, Dr. Barry found a mons veneris covered with hair in the usual way; an imperforate penis, subject to erections, and about two inches and a half in length, with corresponding dimensions: the dorsum of the penis was connected by the cuticle and cellular membrane to the pubis, leaving about an inch and a half free, or not bound up, and towards the pubic region. This penis had a well formed glans,—a depression in the usual place of the meatus urinarius, with a well defined prepuce and foramen. The scrotum was not fully developed, inasmuch as it was but half the usual size, and not pendulous. In the scrotum, and on the right side of the penis, there was one testicle of the size of a common filbert, with a spermatic cord attached. In the perineum, at the root of the corpora cavernosa, an opening existed through which micturition was performed: this opening was large enough to admit the introduction of an ordinary sized catheter. Having found a penis and one testicle, though imperfectly developed, and without further examination, Dr. Barry gave it as his opinion, that the person in question was a *male citizen*, and consequently entitled to vote and enjoy all the privileges of a free*man!*

On the morning of the 1st Monday in April (election day,) Dr. Barry was informed that Dr. Ticknor would oppose Suydam's admission. Suydam came forward; and Dr. Ticknor objected to him as a female. Dr. Barry then stated to the meeting, that from an examination he had made, he considered the person in question to be a male, and requested that Dr. Ticknor might, with the consent of Suydam, retire into an adjoining room, and examine for himself. This was done, when Dr. Ticknor stated to the meeting that he was convinced that Suydam was a male. Suydam accordingly was admitted a freeman, and his vote was received and registered.

A few days after the election, Dr. Barry heard that Suydam had regular catamenia. The sister of Suydam informed him that she had washed for him for years, and that he menstruated as regularly, but not so profusely, as most women. Suydam, when questioned, very unwillingly confessed that such was the fact. He was again examined by the two physicians, when the following additional particulars were elicited:—Said Suydam is five feet two inches in height, light-coloured hair, fair complexion, with a beardless chin, and decidedly of a sanguineous temperament, narrow shoulders and broad hips; in short, every way of a feminine figure. There were well developed mammæ with nipples and areolæ. On passing a female catheter into the opening through which micturition was performed, and through which, he again stated, he had a periodical bloody discharge monthly,—instead of traversing a canal and drawing off urine, the catheter appeared to enter immediately a passage similar to the vagina, three or four inches in depth, and in which there was a considerable play of the instrument. He stated that he had amorous desires, and that, at such times, his inclination was for the male sex: his feminine propensities, such as a fondness for gay colours, for pieces of calico, comparing and placing them together, and an aversion for bodily labour, and an inability to perform the same, were remarked by many.

Dr. Barry further learned from an old lady, who was present at the birth of Suydam, that on the second day after his birth, Dr. Delamater, who attended as accoucheur, made with an instrument the opening through which he has ever since performed micturition. (American Jour. of the Med. Sciences, July, 1847.)

This is certainly a very puzzling case, and one to which Lord Coke's rule for a decision, *i. e.* the prevalence of sex, is hardly applicable. The presence of a penis and one testicle referred the being to a male, while the bodily configuration, and still more strongly the periodical menstrual discharge, referred him to the female sex. The right of voting might have been fairly objected to, because, while the female characters were decided, the organs indicative of the male sex are described as having been very imperfectly developed.

[A case of doubtful sex, which may hereafter give rise to much greater perplexity than the foregoing, and for still more important and complicated reasons, has lately been reported with remarks by Prof. S. D. Gross. (Am. Jour. Med. Sci., Oct., 1852, 386.) It possesses unusual interest and importance on account of the very high position of its reporter, as well as on account of the novel, and, as we feel bound to say, most unjustifiable operation which was resorted to as a remedial or palliative measure, and is now suggested as illustrating "a *new principle in juridical medicine.*" This palliative operation consists in an attempt by castration to destroy all sexuality in an infant, because that infant had been already so unfortunate as to be born with imperfect sexual organs!

The subject of the case was three years of age when first seen by Dr. Gross, having been born on the 10th of July, 1846. "She" (we here quote the Dr.'s language, without, however, being convinced of the character of sex implied by the personal pronoun used,) "had always up to this period been regarded as a girl, and had been so pronounced at her birth by the accoucheur. At the age of two, however, she began to evince the taste, disposition and feelings of the other sex; she rejected dolls and similar articles of amusement, and became fond of boyish sports. She was well grown and perfectly healthy, and quite fleshy.

Her hair was dark and long, the eyes black, and the whole expression most agreeable. A careful examination of the external genitals disclosed the following circumstances: there was neither a penis nor a vagina; but instead of the former there was a small clitoris, and instead of the latter a superficial depression or *cul-de-sac*, covered with mucous membrane, and devoid of every thing like an aperture or inlet. The urethra occupied the usual situation, *i. e.* usual in the female we suppose, and appeared to be entirely natural: the nymphæ were remarkably diminutive; but the labia were well developed and contained each a well formed testis, quite as large and consistent as this organ generally is at the same age in boys. Her hips and chest, thighs and superior extremities were perfect." The foregoing constitutes the only anatomical description given, and although not a very precise and full one, it is yet sufficiently decisive to establish at least the predominance of the male sex, suggested by the child's own natural language. No uterus or ovaries appear to have been found or sought after; nor do we find any peculiarities of external formation noticed that do not sometimes occur in the most common variety of hermaphroditic malformation, *i. e.* the male variety, in which there is arrest of development but no intermixture of the sexes, the distinctive organism being masculine. (See ante, p. 428.) Having ascertained that the case "was one of malformation of the genital organs, usually denominated hermaphroditism, the question occurred whether any thing could or ought to be done to deprive the poor child of that portion of the genital apparatus which, if permitted to remain until the age of puberty, would be sure to be followed by sexual desire, and which might thus conduce to the establishment of a matrimonial connexion."

After much deliberation, aided by the counsel of medical friends, and especially by that of a colleague of high standing, (who considered that "it would be an act of kindness and of humanity to the poor child, standing as she did towards society in the relation, not of a boy or a girl, but of a neuter, to deprive her of an appendage of so useless a nature; one which might, if allowed to proceed in its development, ultimately lead to the ruin of her character and peace of mind,") and encouraged by the expressed anxiety of the parents to save their child "from future suffering and misfortune—Dr. Gross at length determined upon excision of the testes. Accordingly, on the 20th of July, 1849, the patient being then over three years old, he removed each testicle from its place in the corresponding labium. "The testes," he remarks, "were carefully examined after removal, and were found to be perfectly formed in every respect. The spermatic cords were natural." Here then we have, what is rare during life in these cases, a certain amount of confirmatory evidence from internal anatomical inspection, that the child operated on was a male child. The question of sex, however, is not the material one here, although it may come up more seriously some years hence elsewhere, and we shall not dwell upon it in this place.

To go on a little further, however, it may be stated that the emasculation appears to be complete, for we are informed that, in the course of the three years since elapsed, the "disposition and habits have materially changed, and are now those of a girl: she takes great delight in sewing and housework, and she no longer indulges in riding sticks and other boyish exercises." This entire change from the natural language of one sex to that of the other, especially if eventually followed by development of the breasts, the catamenial flow (and other characteristics of the female sex,) would give rise to the suspicion that there were at least one ovary to be taken away, besides the two testicles, and that, after all, the good work had been only half done, since the dreaded matrimonial catastrophe might be as imminent as ever.

"A defective organization of the external genitals," Dr. Gross forcibly observes, and he might have added of the internal also, "is one of the most dreadful misfortunes that can possibly befall any human being. There is nothing that exerts so baneful an influence over his moral and social feelings, which car-

ries with it such a sense of self-abasement and mental degradation, or which so thoroughly 'maketh the heart sick,' as the conviction of such an individual that he is for ever debarred from the joys and pleasures of married life, an outcast from society, hated, despised, and reviled and persecuted by the world." Again, "if hermaphrodites are no longer burnt and drowned, stoned and persecuted, and mocked and reviled, they are invariably regarded with a degree of prejudice, amounting generally to positive aversion; and as unfit for any offices of dignity, divine, legal, or political. If such be the fact, and no one can doubt it, [it is doubted] every suggestion calculated to ameliorate the condition of this unfortunate class of beings, by depriving them of their only incentives to matrimony, and thereby dooming them to everlasting celibacy, should be hailed as a valuable contribution to the science and humanity of the age." In these different quotations, given at greater length we fear than the subject actually claims, we have endeavoured to present all the material facts of the case and all the arguments stated in support of the precedent suggested in connexion with the case. Having gone thus far, we must say that the reasons offered would, with many minds, as they do with ours, operate more conclusively against the operation, than in its favour. In the first place, admitting, what is taken for granted without sufficient reason, that the establishment of a matrimonial connexion, or the attempt to establish one, may be a necessary consequence or a necessarily probable consequence, of the existence of sexual passion, still experience shows that the extinguishment of sexual feeling does not remove this dreaded liability; for it is well known that impotent persons of both sexes are married, and do seek matrimonial alliances, notwithstanding their legal as well as physical disability. We thus see that removal of the testes does not deprive individuals of their "only incentives to matrimony," although it may legally doom them to "everlasting celibacy." If the unfortunate subject of this case is to grow up as an attractive woman, the liability to matrimonial proposals must be almost certain, and cannot fail to create a vast deal of painful embarrassment, not to say grievous disappointment, involving most unpleasant and unsatisfying explanations, much of which, for all that can be proven to the contrary, might have been avoided by attention to the dictates of a less officious humanity, and a more patient watching of the dictates of nature in the person most concerned. If the so called hermaphrodite be an object of so much commiseration in his natural condition, even at full growth, how can he be made less so by a still more degrading and universally detested mutilation? This mutilation not only lowers him still further in his social condition, but stunts, depraves, and distorts his whole development, physical and psychological, increases the difficulty in later life of distinguishing his predominant sex, thereby affecting his legal and political rights, and finally deprives him of the inalienable privilege of subduing and controlling in his own way those sexual manifestations which are habitually ignored by hundreds and thousands of both sexes, whose circumstances, of various kinds, place them beyond the pale of married life.

In a word, then, the precedent proposed cannot be sustained, because, 1st, the mutilation is inflicted at an age when the party most concerned, and the only one who ought to be consulted, can have no voice in the matter. 2dly, by violently interfering with the course of nature, it may seriously impair the development of mind and body, and so far mask the physical and functional changes characteristic of the sexes at the different epochs of life, as to make it difficult, if not impossible, to determine the real sex when in due time this shall come to be inquired into for political and business purposes. 3dly, it does not attain the end of removing the sole inducements to matrimonial enterprises, which is the grand object kept in view by its author; and, therefore, 4th, the utmost it does is to remove a tantalizing desire, and lessen the liability to disagreeable exposures and disappointment, while it aggravates a distressing and mortifying infirmity by superadding another that is equally mortifying, if not equally dis-

tressing, and which need never be required as a mere matter of expediency by any reasonable person.—H.]

Concealed sex.—It is almost superfluous to say, that in some cases sex cannot be determined by the dress, appearance, or even voice of the individual. Cases in which males have passed for many years unsuspectedly as females, and *vice versâ*, have been very numerous. In some instances the secret has only been disclosed by death. Facts of this kind belong rather to the annals of imposture than to those of medical jurisprudence. A somewhat singular case of this description, that of *Eliza Edwards*, occurred to me in 1833. An unclaimed body was sent to Guy's Hospital, by the Inspector of Anatomy, as a female. On removing the dress, however, it was found to be that of a *male!* From some suspicion respecting the cause of death, and the habits of this person, a coroner's inquest was held. It turned out that the deceased, whose age was 24, had assumed the dress of a female at the age of 14; and had performed in many parts of England as an actress. The features had a somewhat feminine character; the hair was very long, and parted in the centre; the beard had been plucked out, and the remains of this under the chin had been concealed by a peculiar style of dress. It was remarked during life that the voice was hoarse. The breasts were like those of a male, and the male sexual organs were perfectly developed. They had evidently been subjected to great traction, and appeared to have been drawn forward to the lower part of the abdomen. The state of the rectum left no doubt of the abominable practices to which this individual had been addicted. It was found that death had taken place from natural causes. The most remarkable circumstance in the case is, that the deceased had been attended in his last illness by an eminent physician for disease of the lungs; and so accurately was the imposition maintained, that his medical attendant did not entertain a suspicion of the real sex of his patient! (Med. and Phys. Jour., Feb. 1833, 168.)

IMPOTENCY. STERILITY.

CHAPTER LV.

IMPOTENCY—DEFINITION—PHYSICAL CAUSES. PROCREATIVE POWER IN THE MALE—PUBERTY—AGE OF VIRILITY—LOSS OF VIRILE POWER BY AGE—DISEASES OF THE TESTIS—POWERS OF CRYPSORCHIDES AND MONORCHIDES—SUPERNUMERARY TESTES—ARRESTED DEVELOPMENT—MORAL CAUSES. STERILITY—CAUSES OF—PROCREATIVE POWER IN THE FEMALE—PUBERTY—EARLIEST AND LATEST AGES FOR CHILD-BEARING—FEMALE PRECOCITY—MENSTRUAL CLIMACTERIC—AGE FOR CESSATION—REMEDIABLE CAUSES OF STERILITY—LEGAL RELATIONS OF THE SUBJECT—CONTESTED LEGITIMACY AND DIVORCE.

IMPOTENCY.

Definition.—Impotency is defined,—An incapacity for sexual intercourse. It may depend—1st, upon *physical;* 2d, upon *moral* causes. With regard to the latter, namely, the *moral causes* of impotency, a medical jurist has no concern whatever,—since no such causes are recognised by law; and he has no duty to perform beyond the application of the principles of medicine to the purposes of the law.

Impotency may depend on *age,*—on certain *physical causes, e. g.* disease,—or on congenital malformation or *defect.* With regard to *physical* causes, a division must be made between those which are remediable, and those which are not. The presence of disease of the testicle, such as atrophy or fungous tumours, may give rise to incapacity; but the incapacity may be sometimes removed by an operation or by medical treatment, and therefore the physical cause may be removed:—in other words, it is *remediable.* Now to such cases as these the law does not extend; but it is always expected, in alleged incapacity, that the practitioner examined on the subject should be able to say whether there be or be not a prospect of cure. Upon this point, his knowledge of his profession can alone assist him; no rules can be laid down for his guidance, for there may not be two cases which will precisely resemble each other in their features. Hence it will be necessary to point out the chief causes of impotency which are of an irremediable nature, or those in which the incapacity is absolute and permanent;—a point upon which the law chiefly solicits a medical opinion.

In strictness of language, the definition of impotency, as above given, may exist in the *female* as well as in the male; and undoubtedly a physical incapacity for sexual intercourse may exist in either sex. As an instance of this incapacity in the female, may be mentioned occlusion or obliteration of the vagina—a condition not necessarily indicative of sterility. The mere occlusion of the vagina may be a remediable form of the malady; but its entire obliteration would be absolute and irremediable. This latter condition, however, is the only instance of complete impotency in the female. Protrusion of the uterus or of the bladder into the vagina, are mentioned by some writers as causes of physical incapacity for intercourse: but these forms of disease may commonly be remedied by art, and therefore require no further notice.

In professional language, impotency is applied exclusively to defect in the

male sex; and the term sterility is confined to all those conditions in the female, which not only render intercourse impossible, but which render it unfruitful.

Procreative power in the male. Puberty.—Until the period of puberty, the testes remain small, and increase very little in size in proportion to other parts. Mr. Curling found that the size of the seminal tubes differed but little at the ages of eighteen months and eight years. (Diseases of the Testis, 40.) The sexual function in the male depends entirely on the development of these organs; but the age at which it appears differs in different individuals. The age of puberty in a healthy male in this country varies from 14 to 17 years: its appearance is, however, affected by climate, constitution, and the moral circumstances under which the individual is placed. In some cases it is not fully developed until the age of 21.

The seminal secretion in the male is not considered to be prolific until it contains those peculiar filiform bodies which are known under the name of *spermatozoa* or zoosperms. These are regarded by some physiologists as parasitic animals, but by others, with some probability, as freely moving cilia. (Recent Advances, Baly and Kirkes, 1848.) All agree that they are normal and essential constituents of the seminal fluid. They are peculiar to the spermatic secretion, and, in healthy subjects, are always present in it after the age of puberty. They disappear in certain states of disease; and when not found, it is a fair inference that the individual is impotent, or that he has lost the power of procreation. The age at which they appear in the spermatic secretion varies with all those causes which affect puberty. Mr. Curling informs me that he found them in the secretion of a boy aged 18; but his observations have not been specially directed to this question. There is no doubt that in many cases they appear much earlier than this. Sexual propensities are often strongly developed in young children, and they may be prolific at a very early age. Dr. Rüttel met with a case in which a female at the age of 14 became pregnant by a boy of the same age. (Henke, Zeitschrift, der S. A. 1844, 249.) This is the earliest stage at which, so far as I can ascertain, the procreative power has appeared in the male. In a case of contested legitimacy or affiliation, this question may have an important bearing.

[See Am. Jour. Med. Sci. Oct. 1852, 561, for a case of "*extraordinary Precocity in the Development of the male sexual Organs and muscular System in a Child Four Years old.*" By Prof. R. K. Stone, of the National Med. Coll., Washington, D. C.—H.]

The person may be so *young* as to render it impossible that he should be the father of a child imputed to him. Cases involving questions of legitimacy on this ground are not heard of in the present day; but in ancient law-books there are decisions relative to the illegitimacy of children born during marriage, because the alleged fathers were seven, six, and even three years old! (Amos.)

The following case in reference to the affiliation of children occurred in 1840; —A woman wished to affiliate a child on a youth who was in his *sixteenth* year. The boy denied that he was the father of the child; and there was reason to suspect that the imputation had been wrongly thrown upon him in order to divert suspicion from the real party. There was some difficulty in this case; but it appears to me that the rule for a medical man to follow on these occasions is this: —not to regard the mere *age* of the youth, whether he be above or below the average age of puberty, but to observe whether the sexual organs be fully developed, and whether there be about him any of the ordinary marks of virility, indicated by muscular development, the growth of a beard, and a change in the voice. If these signs be present, whatever may be his age, there is strong reason to suppose that the sexual functions are developed. We occasionally hear of instances of extraordinary precocity; but the development of the sexual power is generally accompanied by other well marked changes in the individual. Sometimes these changes do not make their appearance until after the age of twenty-one.

On the other hand, it may be a question at what time the procreative power disappears in the male. That impotency is one of the natural consequences of *advanced age* is undoubted: but this, as we know, forms no legal impediment to the marriage of parties however old. The legal presumption is, that the generative faculty does not disappear through age; and if this be alleged, and legitimacy disputed on this ground, it must be satisfactorily proved. This amounts almost to an impossibility; because it is well known that there is no fixed age at which the sexual functions cease either in the male or female: and individuals, at least of the male sex, who had passed the ages of sixty, seventy, and even eighty years, have been known to be prolific. In relation to this question it may be mentioned as an interesting physiological fact, that Mr. Curling found spermatozoa in the liquid taken from the testicles of a man upwards of seventy years of age, and on one occasion in the testicles of a person aged eighty-seven. (Diseases of the Testis, 40.) Dr. Rüttel mentions the case of a man who, at the age of 92 years, married and had two children by his wife! When the procreative power even appears to be lost at an advanced age, the stimulus for sexual intercourse is often very great. The same authority mentions cases in which the erotic feelings were remarked by him in reference to men between 75 and 80 years of age. (Henke, Zeitschrift, 1844, 252.) In all cases of protracted virility it is observed that the general bodily powers are also retained in an extraordinary degree, showing the very close relation which exists between sexual function and corporeal development even to the latest period of life.

The English law on this subject was clearly laid down in the *Banbury Peerage case*, brought before the House of Lords many years since. Lord and Lady Banbury had been married twenty-one years without having had issue, when his lordship died at the age of eighty years. The peerage was claimed by an individual who called himself the son of Lord Banbury; but in fact it was alleged that he was the son of Lady Banbury by an adulterer, during her husband's life. According to the evidence, Lord Banbury did not appear to have been aware of his existence; and the child had always been known by another name. One of the grounds upon which the legitimacy of the descent of the claimant was contested was, that the deceased nobleman had become impotent through *age*: but it was then stated on good legal authority, that the law placed no limit on the powers and faculties of men. The assumed impotency of the alleged parent on the ground of age, could never be admitted as a proof of the illegitimacy of the supposed offspring. The House decided against the claim, but not on the ground of impotency from age in the husband. (See in reference to this subject. Henke, Zeitschrift der S. A. 1842, ii. 162, 330.)

Impotency from disease or accident.—The loss or destruction of the penis or testicles, either by disease, accident, or from necessary operations, would be sufficient to render an individual irremediably impotent. The loss of one or both testicles from any of these causes would be indicated by the presence of distinct cicatrices in the scrotum. When both have been removed by operation, the individual is incurably impotent; but if the organs be healthy, a sufficiency of the spermatic fluid to confer procreative powers may remain in the ducts for two or three weeks after the operation. The loss of *one* testicle only does not render a man impotent. *Monorchides*, as they are called, have been known to be prolific. Cases of this kind must not be confounded with those in which one or both testicles have not descended into the scrotum. In some rare instances, the organs do not descend into the scrotum at the usual period; but one or both may remain in the abdomen, or in the inguinal canals, and only descend some time after birth; or one may be found in the scrotum, and the other remain during life in the abdomen. In these cases the organs have been mistaken for, and treated as ruptures by the application of a truss! (Henke, Zeitschrift der S. A. 1844, i. 249.) When one of the organs only has descended, there is no ground cæteris paribus to impute impotency. When neither has descended, the

scrotum will be found empty, without any cicatrix, but all the other marks of virility may still be present. These individuals have been called *Crypsorchides*. It has been said that in all such cases the testicles are to be regarded as congenitally deficient; but this is an error. Dissection has clearly proved that they have merely *not* descended; and although remaining in the abdomen, there is no reason to believe that they were incapable of performing their functions. This absence of the testicles is a state very rarely seen. Mr. Marshall met with only one case of non-descent of one testicle in 1000 recruits, and with one case of non-descent of both testicles in 10,000 recruits. There are three preparations, showing the non-descent of the testes, in the museum of Guy's Hospital: one of them was taken from a gentleman who shot himself from despondency at his supposed defective condition. Hunter thought that the undescended testicles were imperfect both in their organization and functions, and that crypsorchides were invariably impotent. But the recent researches of Mr. Curling and others have shown that there is no foundation for this opinion. My friend Mr. Cock informs me that he has taken notes of the cases of two men whose testicles had not descended, and in whom the virile functions were perfect. One of them, before he had reached the age of thirty years, had already married twice, and had had children by each wife, besides illegitimate children which were affiliated on him during the time he lived in service! In general it will be found that the usual signs of virility have appeared about the person. If, in a case of non-descent, there should be a non-development of the other external organs, and this is accompanied by a total want of the characters of virility, no doubt can be entertained that the individual is irremediably impotent. The testicles may, in such a case, be really congenitally absent—a fact only ascertainable by a post-mortem examination. I quite agree with the opinion expressed by Mr. Curling, which is confirmed by the facts above mentioned, that the detention of the testicles in the abdomen is perfectly compatible with virility; and in cases where there are no external marks of effeminacy, or other grounds for suspecting impotency, and the patient is subject to erections, the imperfection does not offer any bar to marriage, nor is it a justifiable ground for divorce.

The presence of what have been called supernumerary testicles does not affect the virile powers of the individual. These have in general been found, by dissection, to be tumours connected with the healthy glands, and not at all interfering with their functions.

In some cases there is an arrest of development in the external organs. In general, with this there is no sexual desire. Mr. Farr met with a case in which, in a man aged forty-two, the sexual organs remained undeveloped and in an infantile state. There was some difficulty in finding the testes, in consequence of their smallness. On examining the contents of the gland microscopically, no spermatozoa were found. This person's voice was effeminate, and he was devoid of hair on the chin and pubis. (Med. Gaz. xl. 857.) It is not, however, always to be inferred, that an individual with undeveloped organs is incurably impotent. The following case is quoted by Mr. Curling:—A gentleman, aged twenty-six, consulted Mr. Wilson on the propriety of his marrying. His penis and testicles very little exceeded in size those of a youth eight years of age, and he had never, until this acquaintance with his intended wife, felt the desire of sexual intercourse. He married, and became the father of a family; and at the age of twenty-eight, the organs had acquired the full development of the adult. (Op. cit. 95.) Under wasting of the testicles, or when the gland is extensively diseased, and the sexual desire disappears, there can be no doubt of impotency. The functions of these organs are not, however, very readily impaired by local disease. The spermatic secretion is still properly formed, even when only a small part of the gland remains healthy,—a fact proved by a microscopic examination of the discharge. Certain diseases of the appendages of the testes may, however, render a person impotent. The spermatic secretion is commonly suspended in most severe diseases which affect the body.

A very frequent cause of impotency in the adult, when the organs are apparently sound, is spermatorrhœa, arising from abuse. This, however, is remediable to a greater or less extent by treatment.

Of *moral* causes it is unnecessary to speak. The sexual desire, like other animal passions, is subject to great variation; and there are instances on record, in which men, otherwise healthy-looking and healthily formed, have experienced no desires of this kind. They are in a state of natural impotency; a condition which the Canon law designates as frigidity of constitution. This is not to be discovered by examination, but rather from their own admission.

On the absence of the penis as a cause of impotency, as well as on its defective organization, some remarks have been already made in the preceding section. Sometimes the defect is merely connected with the urethra. Thus the orifice may open on the dorsum penis, and in other cases underneath the organ, so that the urethra may terminate at a variable distance from the glans penis. Those labouring under the former defect are said to have *epispadia;* and under the latter, *hypospadia.* The power to have fruitful intercourse will in either case depend on the situation of the urethral aperture. Rüttel knew an instance of a hypospadian having several children. (Henke, Zeitschrift, 1844, 258.)

Since the publication of the former edition of this work, some discussion has taken place in the medical journals respecting the virile powers of those who are affected with hypospadia. In September, 1850, a lad, aged seventeen, was summoned before the magistrates of Kidderminster on a charge of affiliation in reference to the pregnancy of a girl aged eighteen. The defence was, that he could not be the father of the child, because there was such a malformation of the penis as to prevent prolific intercourse. On examination, the urethra was found to terminate on the under surface of the penis, about an inch and a half from the glans, by a small elliptical orifice, which allowed the urine to pass, but with some difficulty. One medical witness gave it as his opinion, that it was not impossible, but highly improbable, that the defendant should become a father; another freely admitted the boy's capacity, and it was decided against the accused. (Med. Times, Sept. 21, 1850, p. 321.) There can be no doubt that this was a correct decision. When the urine can pass, the seminal fluid can pass; and the only question is, whether the intromission can be such as that the misplaced orifice should come in contact with any part of the vagina. Cases illustrative of the fully prolific powers of hypospadians will be found in the Med. Times, Sept. 14, 1850, p. 292; and Oct. 12, 1850, p. 392. Similar remarks apply to epispadians. These malformations are sometimes remediable: but whether remediable or not, they are not, under any circumstances, to be regarded as absolute causes of impotency.

The incapacity for intercourse in either sex may arise from *extensive disease* affecting parts in and around the organs of generation. The medical opinion here must be regulated entirely by the circumstances attending each case.

STERILITY.

Definition.—Sterility is usually defined to be "the inability to procreate, or a want of aptitude for impregnation." It is not usual to speak of sterility in the male, although there may be procreative incapacity; because the defective condition in this sex is fully expressed by the word impotency. In the strictness of language, a male who has been castrated is sterile; but it is sufficient to say that he is impotent. It is possible that many apparently healthy and well formed males may be sterile without being impotent, *i. e.* that they may have intercourse without procreating—for the power to copulate must not be confounded with that of procreation: but it is more probable that the defect in such cases rests with the female, and not with the male. Sterility should, therefore, imply that condition of the female in which there is an "inability to conceive." This appears to be

the true meaning of the term, and the sense in which it is used, not only by the best writers, but in common phraseology.

Procreative power in the female. Puberty.—In the *female*, the procreative power is supposed not to exist until after the commencement of menstruation, and to cease upon the cessation of this periodical secretion. The menstrual function is commonly established in females in this climate between the ages of *fourteen and sixteen;* but it may occur much earlier: indeed, in some rare instances, a discharge resembling the menstrual has been known to occur in mere infants. In other cases its appearance has been protracted to a much later period.

According to Dr. Rüttel, the menstrual function appears in the smallest number of females at 12, 13, and 14 years, and in the largest number at 16, 17, and 18. In many it is only first established at from 19 to 21 years; and he states that at this age he has often found the uterus very small, and quite undeveloped. Perhaps, in this country, the most frequent age for menstruation may be taken at 15 years. It is liable to be accelerated in its appearance by certain moral and physical conditions under which the female is placed. The most common intervals for the appearance of the function are twenty-eight and twenty-one days. It is sometimes late in life before it appears. Dr. Camps found that it had not appeared in a married woman, æt. 30, who had borne no children. (Med. Gaz. xxxix. 409.) Another case is mentioned in the same volume where it appeared for the first time at 47 (p. 567.) So soon as this function commences, the female may be considered to have acquired procreative power; but a female may conceive before the function has commenced, during the time of its occurrence, or after it has ceased. From facts elsewhere stated there is some reason to believe that the period which immediately precedes or follows the discharge is that which is most favourable to conception.

It is important to remember that these changes in the uterus may produce remarkable effects by sympathy with the brain and nervous system. At or about this period, more especially if any cause of obstruction exist, females become irritable, easily excited, and they have been known to perpetrate, without motive, crimes of great enormity, such as murder and arson. A propensity to steal also sometimes manifests itself. It has been remarked that acts of arson have been frequently committed by young girls at this period of life, and the crime has spread by imitation. The case of *Brixey*, tried for the murder of an infant, and acquitted on the ground of insanity, will serve as an illustration of the morbid effect produced on the brain by disordered menstruation. (See post, INSANITY.) The state of the mind should be therefore carefully watched at this period of life. Chlorosis or amenorrhœa may give rise to temporary insanity. Puberty in the male may be attended with similar morbid propensities; but these are not so commonly witnessed in this as in the female sex.

Pregnancy before menstruation.—The occurrence of menstruation is not indispensable to pregnancy. Many cases are on record where women who have never menstruated have conceived and borne children. One case is reported in which a female, aged 25, became pregnant and bore a child, and menstruation was only regularly established afterwards. (Lancet, Feb. 1842.) Dr. Murphy mentions another case of pregnancy previous to menstruation, in a woman aged 28. (Obstetric Reports, 1844, p. 7.) Numerous cases of conception without previous menstruation are quoted by Capuron, (Méd. Lég. des Acc. 96;) and no less than nine instances of pregnancy before menstruation have been collected by Mr. Whitehead. The females were all in excellent health during the whole time, and one did not menstruate until more than two years after the marriage had been consummated. (On Abortion, 223; see, also, Orfila, Méd. Lég. 1848, i. 257.) Another case has been recently reported. (Med. Gaz. vol. xliv. p. 969.)

Instances of *premature puberty* in the female are now very numerous:—they are far more common than in the male sex. Mr. Whitmore met with the case of a female child who, from a *few days* after birth, had her catamenia regularly at periods of three weeks and two or three days, until she had attained the age

of four years, when she died. On inspection after death, she appeared like a much older girl. The breasts were unusually large, and the female organs and lower limbs were considerably developed. (North. Jour. Med. July, 1845, p. 70.) Another case has been recently reported in the Lancet (Jan. 29, 1848, p. 137.) This was a child aged three years. The breasts were as healthily developed as in an adult of twenty years; and the female organs were also as much developed as in a girl at the age of puberty. It was found that this child had the appearance of a little old woman, who had been regularly menstruating for twelve months. (For other cases of menstruation at five years, see Med. Gaz. xxv. 548; and at three years, vol. xlvii. p. 244.) In these instances there is great reason to believe that the procreative powers are very early developed; but it is not common to hear of such young females becoming impregnated. A case is mentioned by Dr. Beck, where a female menstruated at one year: she became pregnant and was delivered of a child when little more than *ten years* old. Dr. Walker met with a case in which the menstrual function was established at the age of eleven and a half years, and the patient was delivered of a living child when only twelve years and eight months old. (Amer. Jour. Med. Sci., Oct. 1846, p. 547.) In another, observed by Rüttel, already referred to, a female of the age of *fourteen* became pregnant by a boy of the same age. He also refers to three others, where one girl of the age of *nine*, and two of the age of *thirteen*, became pregnant (loc. cit.) The first of these three cases represents the earliest age for pregnancy yet assigned by any author.

I am indebted to Sir Eardley Wilmot, Bart., for the particulars of an interesting case which was the subject of a trial on the Midland Circuit. At the Coventry Summer Assizes, 1848 (*Reg.* v. *Chattaway*,) he conducted the prosecution against a man, æt. 45, for a misdemeanor in having had carnal knowledge of a girl named *Sprason*, between the ages of ten and twelve years. When intercourse was first had, the girl was *eleven years and eight months old:* it was repeated several times subsequently; and when the prosecutrix gave her evidence in Court, it appeared from the statement of the mother that the child was in the last month of her pregnancy. She was then not quite twelve years and six months old. Sir E. Wilmot ascertained by inquiry that menstruation had commenced in this girl at the age of *ten years and two months*, and had continued regularly up to December, 1847, which was about the time when she first had intercourse with the prisoner. It appears that she was a factory girl; and to the heat, confinement, and association with males, to which girls are subjected in this employment may be referred the early commencement of puberty. When menstruation has thus commenced, conception may always be the result of sexual intercourse. The prisoner was convicted, and sentenced to two years' imprisonment with hard labour. The reader will find some additional particulars in reference to this case by Mr. Smith, of Coventry (Med. Gaz. vol. xlii. page 751.)

Age at which menstruation ceases. Menstrual climacteric.—The average period at which this function ceases in the female is usually at the age of from forty to fifty: but as it may commence very early, so it may continue very late in life. In one case it has been known to cease at the age of 23; in another instance it has continued to the age of 66 and even of 75 years. (Whitehead, op. cit. 145, et seq.) In a case which occurred to Capuron, it continued beyond 60 (op. cit. p. 98;) but a more remarkable case, both of late menstruation and late pregnancy, is quoted by Orfila from Bernstein. A female in whom the function appeared at 20, menstruated until her 99th year. Her first child was born when she was 47, and her seventh and last, when she was 60. (Méd. Lég. 4ème éd. 1848, i. 257; see, also, Briand, Man. Complet de Méd. Lég. 1846, 137.) From these facts, it is clear that it is impossible to fix the age of a female by the period at which this "change of life" occurs. At the best, it can only be an average of a certain number of instances. This question arose in the case of *Clark* v. *Tatom*, (Kingston Lent Assizes, 1848) in reference to the identity of a female, through

whom property was claimed by the husband, who was the plaintiff in the action. The marriage had taken place in 1794: the parties separated in 1809; and the plantiff's wife, as it was alleged, died in 1843, when, by direction of the defendant, the age of 55 was put upon the lid of her coffin. A medical gentleman who attended her in 1841, deposed that from being then in her menstrual climacteric, he should consider her not to have been more than 50 at that time. He stated that the general period for the cessation of menstruation was 44: it was rarely protracted to the age of 50. On this assumption, it was impossible that the deceased could have been the plaintiff's wife, because at the time of the marriage she would have been only *three years old!* On the part of the plaintiff, direct evidence was given to show that the deceased was his wife; and it therefore remains to be considered whether the adverse medical opinion is consistent with medical experience. It is obvious, from the cases above quoted, that menstruation may continue to 66 or 70 years of age, and that this may have been an exceptional instance. The plaintiff had a clear right to this medical presumption in his favour; and admitting that his wife was 17 at her marriage, she would have been menstruating in her 66th year. Hence it is evident that the medical facts of the case were compatible with the evidence adduced on the part of the plaintiff. At the trial these well known exceptional cases of menstruation beyond the 50th year were not even referred to; nevertheless the jury returned a verdict in favour of the plaintiff.

Is it possible for a female to become pregnant after menstruation has ceased?—It is commonly asserted and believed that, under these circumstances, a woman becomes sterile. This is doubtless the general rule; but in a medico-legal view it is necessary to take notice of the exceptions. Mr. Pearson, of Staleybridge, communicated to the Lancet, some years ago, the case of a lady, aged 44, who, up to September, 1836, had given birth to nine children. After this, the catamenia appeared only slightly at the regular periods until July, 1838, when they entirely ceased. Owing to this, she supposed that she was not liable to become pregnant; but on the 31st of December, 1839, therefore eighteen months after the entire cessation of the menses, she was delivered of her tenth child. Hence conception must have taken place at from eight to nine months after the final cessation of the discharge.

Latest age for pregnancy.—The age at which women cease to bear children is usually from forty to fifty years; but as they may menstruate, so they may conceive, beyond the last of these periods. Besides, the facts above mentioned show that the continuance of menstruation is not absolutely necessary for conception. Numerous instances are on record of females advanced in life bearing children. A case is reported by Schmidt in which a well formed female, who was married at the age of nineteen, did not bear a child until she had reached the age of *fifty*. Rüttel observed in twelve women that they bore their last children at ages varying from forty-five to fifty. Ottinger met with an instance of a female bearing a child at fifty. Cederschjald another, where the woman was *fifty-three*, and menstruation still continued. Haller records two cases in which women at *sixty-three* and *seventy* respectively bore children. (Briand, Man. Complet de Méd. Lég. 137.) Nevermann has drawn up a table in reference to the late ages of life in which women have borne children. Out of 1000 cases in 10,000 births, he found that 436 children were borne by females at the ages respectively—

Of 41 years	101	Of 48 years	8
42	113	49	6
43	70	50	9
44	58	52	1
45	43	53	1
46	12	54	1
47	13		

A case has been communicated to the Med. Gaz. (xxxix. 950) by Dr. Davies,

of Hertford, in which a woman was *fifty-five* when her last child was born. She menstruated up to that time.

We cannot pretend to fix the age at which pregnancy ceases to be possible, and beyond which it cannot occur. Questions of this kind have a very important bearing on the subject of legitimacy; and unless the law looks to something more than ordinary experience in such matters, the decisions of Courts might be inequitable. The legitimacy of the claimant of the *Douglas Peerage*, about the middle of the last century, was contested, among other grounds, on the presumed loss of procreated power in the female said to be the mother, who was in the fiftieth year of her age at the time of the alleged birth, and who therefore could not have conceived when in her *forty-ninth year*. Lords Camden and Mansfield decided that this was no objection to the legitimacy of the appellant. The fallacy of trusting to a ground of this kind as evidence of illegitimacy is proved by a reference to the numerous cases already quoted. One somewhat similar to that of the Douglas Peerage occurred in France in 1754. *François Fajat* claimed an estate as heir to his mother. His claim was resisted on the ground that, according to the baptismal registry, his mother could not have been the legitimate heiress of the party through whom the claim accrued; because her alleged age would then have been in her *fifty-eighth* year, and this, it was contended, was beyond the age of child-bearing. Ancient records were searched, and the claim of legitimacy was admitted, because menstruation and conception had been known to occur at periods of life even later than this. (Capuron, Méd. Lég. de la couch. 93.) This author quotes a case in which a healthy woman menstruated until she had passed her *sixtieth year*, and her last child was born when she was *sixty years* of age. (98.) Other cases of births at the age of sixty-three and sixty-five are referred to; but these appear to be of a less authentic kind.

The truth is, in giving a decision, the law is bound to look to the anomalies connected with the exercise of the generative function; and therefore the limited experience of a few witnesses, casually taken, can hardly be expected to supply satisfactory answers to questions of this kind. It establishes no presumption respecting the presence or absence of this power at any period of life; and it therefore leaves each case to rest upon the whole of the circumstances which tend it.

Causes of sterility.—The causes of sterility in the female system are very numerous. Some of them depend upon peculiarities of constitution, the sexual organs being well formed and developed,—others upon latent changes or congenital defects in the uterus and its appendages, only discoverable by an examination after death.

Sterility rarely becomes a medical question in contested cases of legitimacy, for a claim on the part of an individual to be the offspring of a particular woman, unless the female were in collusion with the claimant, could only be made after her death; and if not disproved by medical evidence, showing that the woman could not have borne children, it would in general be easily set aside by circumstances. If the uterus, ovaries, or other parts, were congenitally defective or absent, or if there were external sexual malformation, accompanied by occlusion or obliteration of the vagina, a medical witness could have no difficulty in saying that the woman must have been sterile. A mere occlusion of the vagina, removable by operation, does not necessarily indicate sterility, for the internal parts may be healthy and sound. In some instances, the ovaries or the uterus may be entirely absent, or the Fallopian tubes may be obliterated,—facts which can not in all cases be determined during life; in other instances these organs may exist, but be defectively developed. Dr. Coley relates a case in which, in a female æt. 26, it was found after death that the uterus was not larger than in an infant of one or two years of age. The os and cervix uteri were not larger than a crow-quill in diameter, but perfectly defined: one of the ovaries was imperfect. The patient had on a few occasions observed an appearance resembling menstruation. (Obstet. Record, May, 1848, 169.)

Some of the physical causes of sterility in the female are, however, removable by art. Thus, when the vagina is unnaturally closed, this condition may be often remedied by operation. An instance of this kind is related by Mr. Dumville (Medical Gazette, xl. 1116) in which the female subsequently married and bore a child. It is a fact worthy of notice, that if the internal organs be in their normal condition, the slightest aperture will suffice for impregnation. Penetration is not necessary. Women have thus been known to conceive under circumstances which appeared quite adverse to the possibility of conception; and when they had arrived at the full time, it has been found necessary to make a free incision into the parts which resisted the passage of the child's head. A remarkable case of this kind, which occurred to Dr. Simmons, is quoted in the Lancet (June 19, 1847, p. 651,) and there are many others of a similar nature on record. Sometimes the external passage is free, but the occlusion may be at the os uteri. This is a cause of sterility which, however, admits of remedy by operation. A case of this kind was lately successfully treated by my colleague, Dr. Oldham (Med. Gaz. xxxviii. 919.)

An absence of the menstrual function (amenorrhœa) has been described as a cause of sterility; but several cases have been already mentioned, which show that females who have never menstruated, and who are otherwise healthy and well formed, may become impregnated. When, however, the absence of menstruation depends on occlusion of the mouth of the uterus or other physical causes of the like nature, there will of course be sterility. If, in other respects, the female be well formed, she cannot be regarded as in a necessarily incurable condition. Dr. Oldham has lately published two cases in which the females had attained the age of forty-eight years without having menstruated (Med. Times and Gaz., March 27, 1852, p. 311.) There was general good health, with a proper development of the sexual organs, in both. An inordinate periodical discharge (dysmenorrhœa,) depending on uterine disease, is a very frequent cause of sterility. The disturbed state of health which accompanies this morbid condition may be, however, itself unfavourable to conception. There is a popular notion that women during menstruation and lactation are sterile; but this is incorrect. (Henke, Zeitschrift, 1844, 263.) Leucorrhœa, or that morbid state of the uterus and vagina which accompanies it, is commonly set down as a cause of sterility; but it is well known that some females, who have for years suffered from leucorrhœal discharge, have conceived and borne children. M. Donné thinks that this fact is explicable on chemical principles. He has observed that the zoosperms, on which fecundation depends, live and are active in the vaginal secretion on some occasions, while their motions are speedily arrested on others. In the latter case, he has found the mucus strongly acid, and he considers that this may act noxiously, and destroy the zoosperms. The uterine mucus is alkaline, and in general the zoosperms are unaffected by it: in cases, however, where it was strongly alkaline, their motions were also destroyed. (Cours de Microscopie, 300.) Further observations are required before this theory can be admitted. The physiology of conception, as to the precise time and circumstances under which it occurs, is altogether a mystery. Well organized and healthy women remain sometimes married for years without bearing children: when, without any apparent change of habit, they become impregnated, even after a barrenness of fifteen or twenty years. Any diseased condition of the system is unfavourable to impregnation, and *à fortiori* diseases affecting the uterus or ovaries. Of all these diseases, chronic endo-uteritis, or what may be called irritable uterus, is, in Mr. Whitehead's opinion, one of the most frequent causes of sterility. (On Abortion, 400.) Change of air and climate has in some instances alone sufficed to remove sterility, probably by relieving this diseased condition of the generative organs. It has been remarked, too, of males and females, that there has often been a return of procreative power after recovery from an attack of fever.

On the whole, the physical and irremediable causes of sterility in the female

are not so apparent as in the male, because in the former the generative apparatus is placed internally, and slight changes in its various parts, sufficient to produce permanent sterility, cannot be determined by an examination.

Legal relations of the subject. Divorce.—Sexual malformation, involving impotency or sterility, constitutes one of the *canonical* impediments to marriage, and if matrimony be contracted by a party labouring under such malformation, the contract is voidable. Canonists have reckoned fourteen impediments to matrimony, enumerated in the following quaint hexameters. (Poynter's Doctrine, 84:)—

"Error, conditio, votum, cognatio, crimen
Cultûs disparitas, vis, ordo, ligamen, honestas,
Si sis affinis, si forte coire nequibus,
Si parochi et duplicis desit præsentia testis.
Raptave sit mulier, parti nec reddita tutæ
Hæc facienda vetant connubia, facta retractunt."

In the marriage contract there is implied a capability of consummation, and the incapacity of either party in this respect constitutes a ground for annulling the agreement. "Vir et mulier si se conjunxerint, si postea dixerit mulier de viro quod non possit coire cum eo, si potest (per verum indicium) probare quod verum sit, accipiat alium (Caus. 23.) Quia matrimonium ordinatum fuit non solum ad evitandam fornicationem, sed etiam ad proles procreandas: si matrimonium (tale quale) fuerit, inter virum et mulierem de facto solemnizatum, qui omnino inhabiles sunt, *non propter ætatem*, sed propter aliquod naturale impedimentum ad proles suscitandas, utpote propter importentiam et frigiditatem, maleficentiam, et similia, quæ ipso jure reddant hujusmodi matrimonium nullum. Hæc impedimenta naturalia aliquando contingunt tam in muliere quam in viro et pars gravata agere potest in causâ nullitatis matrimonii." (Oughton, tit. 193, sec. 17.)

As to presumed incapacity from *age*, the law takes no cognizance of it. The Pappian law of the reign of Tiberius forbade women under fifty to marry men of sixty, and vice versâ, but it is now known that females are prolific beyond fifty, and males beyond sixty.

The impediment constituting impotency may arise either from malformation, what the law calls frigidity of constitution, or any physical cause, of whatever nature, which may render intercourse impossible. When the physical defect is not apparent and irremediable, a continued cohabitation of three years is required before a suit can be entertained (Ayliffe's Parergon;) but according to Oughton —"hæc triennalis expectatio non est necessaria ubi statim possit constare de impotentiâ coeundi." Suit for a sentence of nullity may be promoted by either party, and the medical proof required to found a sentence must be such as to satisfy the Court that the incapacity pleaded was in existence at the time of the marriage, and that it still remains without remedy. There should be no delay in instituting the suit, and there should be proof that the impediment was not known to the complaining party at the time of the contract. A longer delay in making the complaint is allowed to a female, without prejudicing her case, than to a male, by reason of the modesty of her sex. In a case which came before the Ecclesiastical Courts in 1845, a singular question arose whether, when there was a capacity of intercourse on the part of the female, with a certainty that from physical defect it could never be prolific, this was sufficient to entitle the husband to a divorce. The female was examined by Drs. Bird, Lever, and Cape; and they reported that the sexual organs were undeveloped, like those of girls who had not reached puberty, that the vagina was only three-quarters of an inch in depth, and that there was no uterus. They stated that sexual intercourse might take place in an imperfect way; but that conception could not result. On a second examination, seven months afterwards, it was found that the vagina had become elongated, and had then a depth of two inches: but there were no medical means of improving its condition or removing the defect.

It was contended for the husband that the defect was natural and irremediable, and that he was entitled to a sentence of nullity of marriage. On the part of the wife, it was insisted that in order to entitle a party to this sentence, there must be an *utter impossibility* of sexual intercourse. The case, it was argued, was one of mere sterility, which was no ground for a sentence. Actual consummation had taken place. Dr. Lushington, in pronouncing judgment, said, that mere incapability of *conception* is not a sufficient ground whereon to found a decree of nullity. The only question is, whether the female is or is not capable of sexual intercourse, or if at present incapacitated, whether that incapacity admits of removal. A power of sexual intercourse is necessary to constitute the marriage bond; and this intercourse must be ordinary and complete, not partial and imperfect; yet it would not be proper to say that every degree of imperfection would deprive it of its natural character. If it be so imperfect as to be scarcely natural, it is, legally speaking, no intercourse at all. As to conception, there is no doubt that the malformation is incurable. If there were a reasonable probability that the female could be made capable of natural coitus, the marriage could not be pronounced void; if she could not be made capable of more than an incipient, imperfect, and unnatural coitus, then it would be void. Dr. Cape stated that under present circumstances there could only be restricted and limited connexion: it could not be called perfect and complete. The vagina might possibly become a little more elongated, but this would expose the female to danger. From these facts the marriage was pronounced null and void. (See American Journal of Med. Sci. Jan. 1848, 305.)

Hence we may infer, that if the vagina had been of its natural length, notwithstanding the absence of the uterus and the impossibility of conception, a sentence of nullity would not have been pronounced. This is rather conflicting with the doctrine, that the main object of a marriage, valid in law, is *ad proles procreandas.*

The nature of the medical evidence required on these occasions will be best understood by the following extract from Oughton:—"Ad probandum defectus judex compellere potest virum ad exhibendum præsentiam suam et ad ostendendum in aliquo loco secreto (per judicem assignando) pudenda sua, seu illos corporis defectus quos mulier objicit (si ex inspectione corporis apparere possint) medicis et chirurgis peritis prius judicialiter in præsentiâ partis adversæ, de diligenter inspiciendo virum et de referendo in scriptis eorum judicium juratis. Et si medicorum et chirurgorum judicium sit quod morbis vel defectus viri fuerit insanabilis et incurabilis (tamen tenentur in relatione eorum judici ipsum morbum seu defectum specificare ne circumveniatur Ecclesia) et quod in eorum scientiâ, doctrinâ, experientiâ morbus aut defectus hujusmodi nullâ re aut arte medicâ curari possit mulier obtinebit in causâ: hoc addito et allegato ex parte mulieris, quod ipsa sit juvenis et at procreationem apta et quod per *tres annos* in simul pernoctarunt et quod quamvis a marito cognosci cupiebat, ab eo tamen cognita non fuit nec cognosci potuit. Et si defectus non possunt directe per medicos et chirurgos juratos, judicari aut decerni; vel forsan dubia sit eorum relatio; allegetu rex parte mulieris, non solum quæ ultimo recitata sunt, sed etiam hoc addito:—*Quod sit virgo intacta nec a quoquam cognita.* Et ad hoc probandum judicialiter jurandæ sunt obstetrices ad inspiciendum mulierem, an vera sint hæc allegata. Et si judicio hujusmodi obstetricam; reperta fuerit virgo, saltem femina intacta nec a quoquam cognita; et si vir non possit aliquos defectus objicere contra uxorem, ob quos cognosci non possit; hæc dictarum mulierum relatio cum judicio medicorum et chirurgorum (quamvis dubio) una cum cæteris prædictis indicii (videlicit in eo quod mulier sit juvenis, et quod concubuit cum viro, per triennium, ac quod ex aspectu apta et idonea videatur ad procreationem sufficiunt ad divortium; seu potius ad pronunciandum *nullum ab initio* matrimonium fuisse inter hujusmodi personas; easque ab invicem, et ab omni vinculo et fœdere conjugali, liberas et immunes fuisse et esse. Et notu

quod si defectus objiciantur contra mulierem probandi sunt isto modo per inspectionem et relationem."

A case of this kind came before the Vice-Chancellor's Court, in February, 1845, (*Wilson* v. *Wilson*,) in which the female produced medical certificates to prove that she was "virgo intacta!" In drawing up certificates of this kind, the medical reporter should bear in mind that females have become pregnant with what is commonly regarded as the chief sign of virginity *intact*. Indeed, the division of the hymen has been often rendered necessary for the delivery of the child. Negative evidence of non-consummation from the physical condition of the female, is therefore of much less value, ceteris paribus, than the affirmative evidence from the existence of a physical defect in the male.

When the defect is not apparent on an examination, the case is attended with considerable difficulty. Divorce has, however, been granted even in these cases, when the husband has acknowledged his incapacity, and when, notwithstanding cohabitation for some years, this admission has been confirmed by an examination of the wife. Even where the male organs do not appear well developed, and sexual desire is absent, great caution is required in drawing up a report. In the case of *Bury*, the marriage was dissolved on the ground of impotency: but this man afterwards married, and had issue,—a fact which proved that, "ecclesia circumveniatur." This gave rise to a difficult question; for it was contended, if the divorce was null, the second marriage was unlawful and the issue illegitimate. It was decided, however, that the second marriage was only voidable; and that, until dissolved, it remained a lawful marriage, and the children during coverture were legitimate. In investigating a case of this kind, where there is no apparent physical defect or malformation, it is necessary to examine the bodily state of the individual, whether he be effeminate, or have about him any or all of the usual marks which attend a virile state. In the latter case the impotency may be temporary; and it would be decidedly unsafe to pronounce an opinion adverse to the existence of a procreative power.

From these considerations, it will be perceived, that in order to justify a suit of divorce, on the ground of impotency or sterility, the impediment to intercourse or procreation must be apparent and irremediable; it must also have existed before the marriage of the parties, and have been entirely unknown to the person suing for the divorce: if it has supervened after the marriage, this is no ground for a suit. The nature of the impediment is to be determined by private medical opinions or affidavits, based on an examination of *both* parties. There is one remarkable circumstance with respect to these cases; namely, that in nearly all of them, the suit is by the female against the male; although there is no reason whatever to suppose that impotency and sexual malformation are more common in males than sterility in females. We rarely hear of a man instituting a suit of divorce on the ground of sterility (incapacity) in the wife; it is, I believe, in most instances, that the wife promotes the suit on the ground of impotency in the husband. The difficulty of establishing incapacity in the female, and the facility of proving impotency in the male, may probably account for the difference. Suits of this kind are sometimes instituted many months and years after the union of the parties; but it is pretty certain that the desire for separation in these cases often depends on some other cause, which the law would not recognise as sufficient of itself, while it would admit the plea of impotency. The French law very judiciously applies the principle of condonation to such cases, so that no suit for nullity of marriage can be entertained, if cohabitation have continued for six months after the discovery of the personal defect. This appears to me more consistent with justice than our own law: but practically, these suits, after protracted cohabitation, are always regarded with great suspicion.

RAPE.

CHAPTER LVI.

NATURE OF THE CRIME—SOURCES OF MEDICAL EVIDENCE—RAPE ON CHILDREN—LEGAL COMPLETION—PROOFS OF PENETRATION—ABSENCE OF MARKS OF VIOLENCE. PURULENT DISCHARGES FROM THE VAGINA—EVIDENCE FROM GONORRHŒA AND SYPHILIS. FROM MARKS OF VIOLENCE—RAPE ON YOUNG FEMALES AFTER PUBERTY. DEFLORATION—SIGNS OF VIRGINITY—PROOFS OF INTERCOURSE. RAPE ON THE MARRIED—RAPE UNDER THE INFLUENCE OF NARCOTICS—ON IDIOTS. MICROSCOPICAL EVIDENCE—LEGAL RELATIONS. SODOMY.

Nature of the crime. Sources of medical evidence.—Rape is defined in law to be the carnal knowledge of a woman by force, and against her will. In ancient times it was punished by castration,—a punishment which, according to Dr. Griffiths, is still retained in Virginia and Missouri, when the crime is perpetrated by a coloured man on a white woman. For a long period it was punished as a capital crime in this country, but transportation for life was substituted for this punishment by 4 and 5 Vict. c. lvi. s. 3. Since this change was made in the law, it has been alleged, on good authority, that the crime has undergone a considerable increase. On the average of four years, rapes increased 57 per cent. (Law Times, Jan. 4, 1845;) and it was stated officially in Parliament, in 1847–8, that the increase had actually amounted to 90 per cent. since the abolition of capital punishment! Medical evidence is occasionally required to support a charge of rape; but it is seldom more than corroborative, because the facts are in general sufficiently apparent from the statement of the prosecutrix. There is, however, one case in which medical evidence is of some importance; namely, when a false accusation is made. In some instances, as in respect to rape on young children, the charge may be founded on mistake; but in others there is little doubt that it is often wilfully and designedly made for motives into which it is here unnecessary to inquire. Professor Amos remarked, some years since, that for one real rape tried on the Circuits, there were on the average twelve pretended cases! In some few instances, these false charges are set aside by medical evidence; but perhaps in the majority, they are developed by the inconsistencies in the statement of the prosecutrix herself. The duty of a medical witness on these occasions is very simple; and perhaps this will be best understood by considering the subject in relation to females at different ages. It may be observed, that the *consent* of the female does not excuse or alter the nature of the crime when she is under ten years of age, since consent at this period of life is invalid; and the carnal knowledge of such a female is rape in law. Even the solicitation of the child does not excuse it.

On being called to examine the person of a female on whom a rape is alleged to have been committed, the first circumstance which the practitioner should notice, is the precise time at which he is summoned,—taking an early opportunity of comparing his watch with some neighbouring clock. This may appear a very trivial matter, and one wholly irrelevant to the duties of a medical practitioner; but

it is to be observed, that the time at which a surgeon is required to examine the prosecutrix may form a most material part of the subsequent inquiry. It will be highly important to the prisoner, if it can be proved that the female did not take the earliest opportunity to complain; and it may be also the means of defeating an alibi, falsely set up by the prisoner in his defence.

Medical evidence of rape may be derived from four sources:—1. Marks of violence about the genitals. 2. Marks of violence on the person of the prosecutrix or prisoner. 3. The presence of stains of the spermatic fluid, or of blood, on the clothes of the prosecutrix or prisoner. 4. The existence of gonorrhœa or syphilis in one or both. This evidence will vary according to the following circumstances:—

ON CHILDREN.

The sexual organs should in these cases present traces of injury, if the crime has been completed, and there has been any resistance on the part of the child; for it is impossible to conceive that forcible intercourse should take place without the production of ecchymosis, the effusion of blood, or the laceration of the pudendum. It has been propounded as a serious question, whether a rape can be perpetrated on a child of this age by an adult man; and medical witnesses on trials have been found to adopt diametrically opposite views on this point. For the legal establishment of the crime, proof of penetration only is demanded; and it would appear from a decision in the case of *Rex* v. *Russen*, that a degree of penetration so slight as not to injure the hymen, would be sufficient to complete the crime. In the case alluded to, the hymen of the child was proved to be entire, and under the direction of the judge, the prisoner was convicted and executed. This trial took place in 1777; but the late Baron Gurney subsequently held, on a trial which took place before him, that there must be a sufficient penetration of the male organ to rupture the hymen; and unless this membrane was found ruptured, the crime would not be complete in law. (*Rex* v. *Groom*, Archbold, Crim. Plea. 406.) This decision was afterwards overruled by the judges, in a case reserved for their consideration by Coleridge, J., and reported in 9 Carrington and Payne. (See also the case of *Reg.* v. *Lines*, 1 Carrington and Kirwan's Reports.) It is now, therefore, an admitted principle, that a sufficient degree of penetration to constitute rape in law, may take place without necessarily rupturing the hymen; but there must be medical evidence to show that, in a special case, there was actual penetration:—the degree of penetration is quite immaterial. It is true that there could not be a complete introduction of the adult male organ into the vagina of a child without a rupture or laceration of the soft parts; but the absence of such marks of violence would not justify a medical witness in denying the perpetration of the crime, since the law does not require proof of a complete introduction. Penetration to the vulva is sufficient.

Proofs of penetration.—In a case brought before a magistrate a few years since, the evidence left no doubt that the crime had been committed on the person of a girl about ten years old. The surgeon stated that there were considerable marks of violence about the pudendum, but completion (*i. e.* penetration) was, in his opinion, physically impossible on a child under ten years of age. Upon this evidence the charge of felony was abandoned. In the following case the child was older, but the facts bear immediately upon the question which we are here discussing. It was tried at the Central Criminal Court, March, 1843; and the particulars were communicated to the profession by Mr. Adams. (Lancet, March 25, 1843.) A man was charged with a rape upon his own child, aged fourteen. Mr. Adams examined the child about two days after the alleged perpetration of the crime; and he found no injury about the vulva or adjacent parts, and the hymen was unruptured. He gave a positive opinion at the trial that no rape had been committed. Two other medical witnesses, men of equal

rience and integrity, stated their belief that the crime had been perpetrated. It appears that they had examined the child soon after the alleged offence, and a day or two before Mr. Adams. The prisoner was acquitted of the rape, but found guilty of the assault. The absence of any marks of injury about the vulva, so short a time after the alleged criminal act, and the fact of the hymen being unruptured, in some measure justified the opinion of Mr. Adams, that there was no medical proof of a rape having been committed: at the same time he candidly restricts his opinion, by saying, that if by rape we are to understand penetration to the vulva, then was it effected; but there was no evidence to show vaginal penetration; on the contrary, the unruptured state of the hymen in a forcible intercourse was against this view. The only remark which this case requires, is, that the statute law says nothing about the rupture of the hymen as part of the evidence; it merely requires proof of penetration. This may occur, and the hymen remain intact. The distinction here drawn by the witness has no real existence. From the decisions of our judges, vulval penetration, whether with or without violence, is as much a rape as vaginal penetration.

In Scotland this question came formally before the judges in the case of *Macrae*. (High Court of Justiciary, 1841.) It was insisted by the prisoner's counsel, that there should be proof of full and complete penetration; and there was no sufficient evidence to show that penetration had taken place into the canal of the vagina beyond the vulva. Lord Meadowbank charged the jury to the effect, that the evidence of the prisoner's guilt was complete; that scientific and anatomical distinctions as to where the vagina commenced, were worthless in a charge of rape; and that by the law of Scotland it was enough if the woman's body were entered. In a case like this, where there was no evidence of emission, and the girl was young, he did not consider it necessary to show to what extent penetration of the parts had taken place,—whether it had gone past the hymen, into what was anatomically called the hymen, or even so far only as to touch the hymen. The prisoner was convicted. (Cormack's Edin. Jour. January, 1846, p. 48.)

Absence of marks of violence.—When, as in the case above related, there are no marks of violence or physical injury about the pudendum of a child, whether because none originally existed, or they had existed and disappeared in the course of time, a medical witness must leave the proof of rape to others. He can only answer questions of possibility or probability, according to the special facts proved. On the other hand, if marks of mechanical violence be present, they must not always be hastily assumed as furnishing proof of rape; for cases are recorded, in which such injuries have been purposely produced on young children, as a foundation for false charges against individuals. The proof or disproof of facts of this kind must rest more upon general than on medical evidence, unless the injuries obviously indicate the use of some weapon or instrument. It should be remembered that the hymen is not always present in young children:—it may be, according to some, congenitally deficient, or, what is more probable, it may have been removed by ulceration or suppurative inflammation of the parts,—a disease to which female infants of a scrofulous habit are very subject. The mere absence of the membrane, therefore, can afford no proof of the perpetration of the crime, unless we find traces of its having been recently torn by violence.

Purulent discharges from the vagina.—The existence of a purulent discharge from the vagina has been erroneously adduced as a sign of rape in these young subjects. The parents, or other ignorant persons, who examine the child, often look upon this as a positive proof of impure intercourse; and perhaps lay a charge against an innocent person, who may have been observed to take particular notice of the child. Some cases are reported, by which it would appear that individuals have thus narrowly escaped conviction for a crime which had really not been perpetrated. This discharge is very common as a result of vaginitis in young children. It often arises from dentition, or local causes of irritation,—

as worms or uncleanly habits, and is observed especially in children of a scrofulous habit. It is met with in girls up to six or seven years of age; and children thus affected have been tutored to lay imputations against innocent persons, for the purpose of extorting money. This state may commonly be distinguished from the effects of violence by the hymen being entire—the non-dilatation or laceration of the vagina—the red and inflammatory condition of the mucous membrane, and the abundance of the purulent discharge, which is commonly much greater than that which takes place as a result of violence. Capuron mentions two cases, in which charges of rape on children were falsely made against innocent persons, on account of the existence of a purulent discharge, the nature of which had been mistaken. (Méd. Lég. des Accouchemens, 41.) For some judicious remarks on this subject, by Mr. Kesteven, see Med. Gaz. xlvii. p. 372.

If the child be labouring under *syphilis* or *gonorrhœa*, this is cæteris paribus evidence of impure intercourse, either with the ravisher or some other person; but we should be well assured, before giving an opinion, that the discharge is really of a gonorrhœal, and not simply of a common inflammatory character. The party accused might be at the time free from that disease, or, if labouring under it, then we should expect that the discharge suddenly made its appearance in the child with its usual severe symptoms, at a certain interval of time after the presumed intercourse; *i. e.* from the third to the eighth day. When these conditions do not exist, it is extremely difficult to form a medical opinion on the subject, since there are no certain means of distinguishing sporadic discharges from those which are gonorrhœal. Under these circumstances, proof must be derived from non-medical sources. A case occurred to M. Biessy, in which a mere mucous discharge in a girl was pronounced to be syphilitic, and the party who was falsely accused of rape narrowly escaped conviction. (Briand, Man. Complet de Méd. Lég. 1846, 81.) We should further distinctly satisfy ourselves that the gonorrhœa in the child, if it exist, could not have arisen from infection by any accident irrespective of intercourse. This limitation is rendered necessary by the publication of a report of two interesting cases by Dr. W. B. Ryan (Med. Gaz. xlvii. p. 744,) in which two sisters, one of one year, and the other of four years of age, received the infection by reason of their being washed in a vessel and with a sponge used by a young woman affected with profuse gonorrhœal discharge. Dr. Ryan clearly traced the origin of the disease to this very unexpected accident. Had an accusation of rape been made against a man labouring under gonorrhœa, it is not at all improbable that this condition of the children would have been taken as an unanswerable proof of his guilt. Cases of this kind, thus accurately observed; convey an important caution to medical witnesses: *i. e.* that they should not infer criminal intercourse merely from the existence of a gonorrhœal discharge, in the absence of marks of violence to the genitals or other corroborative proofs.

As a summary of these remarks with respect to purulent discharges, we may observe, that they should never be admitted as furnishing corroborative evidence of rape, except—1, when the accused party is labouring under gonorrhœal discharge;—2, when the date of its appearance in the child is from the third to the eighth day after the alleged intercourse;—3, when it has been satisfactorily established that the child had not, previously to the assault, any such discharge. It may be said, however, that all these conditions may exist, and yet the prisoner be innocent; for a child may, either through mistake or design, accuse an innocent person. This, however, removes the case entirely from the hands of a medical jurist.

In the case of The *Queen* v. *Mosely* (Cent. Crim. Court, Sept., 1843,) the prosecutrix, a child between twelve and thirteen years of age, charged the defendant with having committed a rape upon her, alleging that she had made all the resistance in her power. Dr. Merriman stated that he examined the prosecutrix

two or three days after the alleged offence was committed, but could not give any decided opinion on the case, although there was every appearance of violence having been used. Another medical witness stated that the prosecutrix had been under his care for the last eight or nine days for a disease (gonorrhœa,) with which, in his opinion, she had been infected for a considerable time; and a third proved that the prisoner was not infected with this disease. Dr. Merriman, however, is reported to have said that the prosecutrix was not labouring under the disease when he examined her. It is difficult to explain how this discrepancy on a matter of fact of some importance could have arisen. The jury acquitted the prisoner, probably not trusting to the statement made by the prosecutrix. In another case, *Reg.* v. *M'Donough*, (Cent. Crim. Court, Oct., 1843,) Mr. French and Mr. Tucker deposed that the gonorrhœa under which the prosecutrix (æt. 15) laboured, had probably not existed longer than a week,—it might have been of longer standing, but it certainly could not have existed for six weeks, the date at which it was alleged that the rape was perpetrated by the prisoner, and the disease communicated. Upon this evidence the prisoner was acquitted.

The following case was tried at the St. Louis' Criminal Court. A man named *M'Comas* was charged with an attempt to violate a child æt. 9. The evidence against the prisoner was chiefly based on an extorted admission from the prosecutrix, and on the discovery on her clothes of certain stains supposed to have been produced by seminal fluid. The mother examined the pudenda, and found them inflamed and discharging matter, although several weeks had elapsed since the alleged attempt. A medical practitioner was called to the girl: he found the nymphæ and orifice in a state of inflammation, which might have arisen from some morbid cause; but he was unable to give any positive opinion respecting the nature of the discharge. About eight days after this, the girl was examined by Dr. Stevens: the parts were still much inflamed, and discharging muco-purulent matter. The hymen was uninjured. The defence of the prisoner was, that he was not guilty of the assault, and that he was not labouring under gonorrhœa at the time of the alleged attempt. He was convicted, and sentenced to three years' imprisonment. (British American Journal, May, 1848, p. 19.) It is quite possible that this was a case of vaginal catarrh mistaken for gonorrhœa; for, as it has been already stated, there are no certain means of distinguishing the two kinds of discharges. The jury, however, appear to have put faith in the testimony of the prosecutrix. The case was therefore decided by moral circumstances, and not by medical evidence. The existence of an unruptured hymen merely proved that there had not been a violent attempt at carnal intercourse.

Marks of violence.—With respect to marks of violence on the body of the child, these are seldom met with, because no resistance is commonly made. Bruises or contusions may occasionally be seen on the lower extremities.

ON YOUNG FEMALES AFTER PUBERTY.

When the crime is committed on a female from the age of ten to twelve years, the facts are much the same as those already referred to, with respect to children below the age of ten years. There is, however, some difference in the legal complexion of the offence. If carnal intercourse be had with the consent of a female between the ages of ten and twelve years, the offender is guilty of a misdemeanor only. Above the age of twelve years, the consent of the female does away with any imputation of legal offence. Females who have passed this age are considered to be capable of offering some resistance to the perpetration of the crime; and therefore in a true charge, we should expect to find not only marks of violence about the pudendum, but also injuries of greater or less extent about the body and extremities. It is probable that in these cases, if the charge were well founded, the hymen would be ruptured, as the intercourse is always presumed to be violent; but there might be some degree of penetration without this being a

necessary result, especially if the membrane were placed far up. At any rate a young female at this age may sustain all the injury, morally and physically, which the perpetration of the crime can possibly bring down upon her, whatever may have been the degree of penetration; and for this reason, it is laid down in our law, that the crime consists in the mere proof of penetration. The fact is, however, generally clearly made out by the statement of the female. With respect to marks of violence on the person, the exact form, position, and extent of these should be noticed; because a false accusation of rape may be sometimes detected by the violence being in a situation in which it was not probable that the ravisher would have produced it. When bruises are found, the presence or absence of the usual zones of colour may occasionally throw light upon the time at which the alleged assault was committed. As these *marks of violence* on the person are not likely to have been produced with the concurrence of the female, they are considered to furnish some proof of the intercourse having been against her will. But the physical appearances of rape about the pudendum may be found, whether the connexion has been voluntary or involuntary. Thus rupture of the hymen, laceration of the vagina, with effusion of coagula of blood, swelling and inflammation of the vulva, and stains of blood on the person or dress, may be met with in both cases. In making an examination, the greatest care should be taken by the practitioner to fix a probable date for the marks of injury to the genitals or other parts of the body, as it is by the aid of such observations that the truth or falsity of a charge may be sometimes clearly established.

Unmarried females of the age here supposed are liable to *muco-purulent discharges* from the vagina, under which the hymen may be destroyed. This kind of discharge arises from inflammation of the vagina, and has been observed to follow an attack of scarlatina. When it exists, its real cause requires the closest scrutiny of the practitioner. (See remarks by Dr. Barnes, Med. Gaz. xlvi. p. 65.) At a more advanced age, young females are frequently subject to leucorrhœa. These cases are not likely to be mistaken for gonorrhœa; as here the female has it in her power to give some account of the circumstances, from which a medical opinion may be easily formed.

Defloration. Signs of virginity.—It will be necessary to say a few words respecting the *signs of virginity*,—a subject upon which, in some medico-legal works, a great deal of poetical discussion appears to me to have been wasted. Independently of cases of rape, this question may occasionally assume a practical bearing in relation to the signs of defloration. In civil cases a medical witness may be asked whether a particular female has ever had intercourse or not. Proof of this fact may be necessary in order to rebut or substantiate statements made in evidence. The question may be, not whether the female has had a child or not, for this would resolve itself into the proof whether delivery had or had not taken place;—it may be limited to the probability or possibility of intercourse on her part, at some antecedent period. Now, a medical jurist, when consulted in such a case, can only be guided by the presence or absence of the external signs of virginity. The hymen may be intact, but this does not prove non-intercourse, because females have been known to conceive with the hymen uninjured; and an operation for a division of this membrane has been actually necessary before delivery could take place. (Henke's Zeitschrift der S. A. 1843, ii. 149.) This may be explained by the membrane being hard and resisting, and at the same time small in extent, *i. e.* only partially closing the vagina. Under opposite conditions, the persistence of this membrane might fairly lead to the inference that the female was chaste, and that there had been no intercourse; but the hymen may be destroyed by ulceration, as a result of inflammation of the genital organs. When the membrane has been thus destroyed by disease or other causes, or when it is congenitally absent, the opinion must be more or less conjectural; for one intercourse could hardly so affect the capacity of the vagina, as to render the fact evident through life, and there is no other datum upon which

a medical opinion could be based. The presence of the hymen is of course quite incompatible with the assumption that the female has borne a child. A question of this kind incidentally arose in the case of *Frazer* v. *Bagley* (Common Pleas, Feb., 1844.) It was alleged by defendant, that the plaintiff, a married man, had had adulterous intercourse with a young female, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. Dr. Ashwell was called upon to examine the party, and he deposed that, in his opinion, the female was a virgin, and had never had a child. (See also Henke, 1844, i. 259.) It is possible, however, that there may be abortion at the early periods of pregnancy, without this being attended with the destruction of the hymen.

This question may become of importance, not only as it may affect the reputation of a female, but the credibility and character of the party who makes the charge of a want of chastity. In 1845, a gentleman, then assistant-surgeon in the Bombay army, was brought to a court-martial on a charge of having deliberately and falsely asserted that on several occasions he had had connexion with a native female. This was denied by the woman, and evidence was adduced to show that she had still what is commonly regarded as the main sign of virginity, namely, an unruptured hymen. In consequence of this, the gentleman was found guilty, and cashiered. The native female was at the time about to be married, and this rendered the investigation all the more important. An assistant-surgeon, who examined the girl, deposed that he found the membrane of a semilunar form, and tensely drawn across the vagina; and this evidence was corroborated by that of a midwife. The inculpated party took up a double line of defence: 1, That the examination of the female was incomplete; 2, that the hymen, if present, would not justify the witness in saying that intercourse could not possibly have taken place. On the first point it is unnecessary here to make a remark; but it appeared, from their own admission, that the witnesses had never before examined females with this particular object. Assuming that there was no mistake, it becomes a question whether non-intercourse could in this instance be inferred from the presence of the membrane. Fruitful intercourse, it is well known, may take place without rupture of the hymen. Some instances of this kind were referred to at the court-martial, but such cases must be regarded as of an exceptional nature. The real question is, whether, unless it be in an abnormal state, intercourse can possibly occur between young and active persons without a rupture of this membrane. Intercourse is not likely to be confined, under these circumstances, to mere penetration of the vulva. The membrane in this female is stated to have been tensely drawn across the canal, and it was not tough; it was therefore in a condition rendering it most easy for rupture. In the case of an old man, or of one of weak virile power, vulval intercourse might be had without destroying the membrane. Such a case could only be decided by the special circumstances which accompanied it. The presence of the hymen unruptured affords a presumptive but not an absolute proof that the female is a virgin; and it shows clearly that there can have been no vaginal penetration. Admitting the statements of the examiners to be correct, it is very improbable that this female had had sexual intercourse on several or even on one occasion: hence the imputation on her chastity was unfounded.

ON THE MARRIED.

The remarks already made apply to married women, with this difference, that when the female has already been in habits of intercourse with the other sex, there is commonly much less injury done to the genital organs. The hymen will, in these cases, be found destroyed, and the vulva dilated. Still, as the intercourse is presumed to be against the consent of the woman, it is most likely that under proper resistance some injury will be done to the pudendum, and there will be also, most probably, extensive marks of violence on the body and ex-

tremities. Such cases are generally settled without medical evidence, from the statement of the female alone, corroborated, as it should be, by circumstances. A distinguished barrister, of great experience in the criminal law, has suggested to me that this statement regarding the *presence of marks of violence* on the pudendum of a married woman, on whom a rape is alleged to have been committed, requires some qualification. He informs me that he was concerned in the prosecution of two cases of rape on married females, in which the crime was completed in spite of the resistance of the female, and there were no marks of violence on the genital organs. In one (*Reg.* v. *Owen and others*, 1839,) it appears that while an accomplice held the head of the female, with her face downwards, between his thighs, the prisoner had forcible intercourse with the woman from behind,—her thighs having been first widely separated. In the second case, an accomplice held the woman down on a bed by her neck, while the prisoner separated her thighs, and thus had intercourse with her. She was examined nine hours afterwards by an experienced surgeon, and he found no mark or trace of violence or injury on or any where near her pudendum. There were bruises on her arms, neck and legs, where she had been forcibly held down. In both of these cases, it will be seen that the woman had not to struggle with a single assailant; and there can be no doubt that if a married woman be rendered powerless by many being combined against her, or if she be rendered insensible by intoxicating drinks, or narcotic vapours, a rape may be perpetrated without any injury whatever to the pudendum. The gentleman to whom I am indebted for the above cases has suggested that a separation of the thighs in a married woman will cause such a dilatation of the parts as to render it easy for the male organ to penetrate the vagina without leaving any traces of violence on the labia or the female organs generally. This is undoubtedly the true explanation.

When a charge of this kind is made by a prostitute, it is very justly received with suspicion, and the case is narrowly scrutinized. Something more than medical evidence would be required to establish a charge of rape, under these circumstances. The question turns here, as in all cases of rape upon adult females, on the fact of *consent* having been previously given or not. This is the point at which the greater number of these cases of alleged rape break down; and it need hardly be observed, that this question has no relation to the duties of a medical witness;—all that he can do is to establish, occasionally, whether or not sexual intercourse has been had, with or without some violence. It is obvious that there may be some marks of violence about the pudendum, or on the person, and yet the conduct of the female may have been such as to imply consent on her part. We must not suppose, as it appears to be commonly done, that medical proof of intercourse is tantamount to proof of rape.

Possibility of perpetrating rape.—Some medical jurists have argued that a rape cannot be perpetrated on an adult female of good health and vigour; and they have treated accusations made under these circumstances as false. Whether on any criminal charge a rape has been committed or not, is, of course, a question of fact for a jury, and not for a medical witness. The fact of the crime having been actually perpetrated can be determined only from the evidence of the prosecutrix and other witnesses. Still a medical man may be able to point out to the Court circumstances which might otherwise escape notice. Setting aside the cases of infants, lunatics, and weak and delicate females, it does not appear probable that intercourse could be accomplished against the consent of a healthy adult female, except under the following conditions:—1. When narcotics or intoxicating liquids have been administered to her, either by the prisoner or through his collusion. It matters not in a case of this kind whether the narcotics have been given merely for the purpose of exciting the female, or with the deliberate intention of having intercourse with her while she was intoxicated,—the prisoner is equally guilty. (See *Reg.* v. *Camplin*, Law Times, June 28, 1845; also Med. Gaz. xxxvi. 433.) The nature of the substance

whereby insensibility is produced is of course unimportant. Thus the vapours of ether and chloroform have been criminally used in attempts at rape. In a case which occurred in France, a dentist was convicted of a rape upon a female, to whom he had administered the vapour of ether. The prosecutrix was not perfectly unconscious; but she was wholly unable to offer any resistance. (Med. Gaz. xl. 865.) Even when the state of unconsciousness arises from natural infirmity, as in idiocy or insanity, carnal intercourse with a female will be regarded as rape. (*Reg.* v. *Ryan*, C. C. C. Sept. 1846.) The female was in this case an idiot, and it was proved that her habits were not loose or indecent. Platt, B. held that if she was in a state of unconsciousness at the time the connexion took place, whether it was produced by any act of the prisoner or by any act of her own, any one having connexion with her would be guilty of rape. The prisoner was convicted. It may be a question whether a man can have forcible intercourse with a female while in a state of unconsciousness from natural sleep. A man was recently charged with rape before a police-magistrate, and the prosecutrix swore that he had effected his purpose during her sleep. The bare possibility of the offence being perpetrated under these circumstances cannot be denied; but this admission would only apply to a case where the sleep was preternatural or lethargic. In this instance the female was a prostitute, and the charge improbable: all such cases can be determined only by the special facts which accompany them. 2. When a woman falls into a state of syncope from terror or exhaustion. 3. When several persons are combined against the female, in which case we may expect to find some marks of violence about her person. 4. A woman may yield to a ravisher, under threats of death or duress,—in this case her consent does not excuse the crime: but this is rather a legal than a medical question.

Loss of physical evidence.—It is necessary to observe, in relation to the examination of females, that the marks of rape, however strong in the first instance, soon disappear or become obscure, especially in those who have been already habituated to sexual intercourse. After two, three, or four days, unless there has been a very unusual degree of violence, no traces of the crime may be found about the genital organs. In unmarried females, and in children, when there has been much violence, these marks may persist and be apparent for a week or longer. Supposing at the period of examination no such marks exist, it may be necessary to consider whether there has been time for them to disappear since the alleged perpetration of the offence; but in such cases it is rarely in a witness's power to express an affirmative opinion of the perpetration of the crime: he must leave this to be proved by the general and circumstantial evidence. Marks of violence on the person can never establish a rape; they merely indicate, *cæteris paribus*, that the crime has been attempted.

Pregnancy following rape.—It was formerly a debated question, whether, in a case of real rape, pregnancy could possibly follow; and this was even proposed as a rude test of the truth of a charge made by a female! Such a question requires no discussion in the present day. Impregnation, it is well known, does not depend on the consciousness or volition of the female. If the state of the uterine organs be in a condition favourable to impregnation, this may take place as readily as if the intercourse was voluntary. Even penetration is not absolutely necessary for impregnation. (See case by Dr. Oldham, Med. Gaz. xliv. p. 48.)

Microscopical evidence.—Of late years, it has been proposed to add to the medical evidence in rape, the examination of *spots or stains* on the linen of the prosecutrix and prisoner. (Ann. d'Hyg. 1834, 210; 1839, 134.) Thus, it has been recommended to infuse the stained linen in water, and examine the liquid with a good microscope, in order to observe whether it contains zoosperms. Cases of rape have in general been tried in this country without reference to this species of evidence; nor is it easy to perceive how this can be necessary to the proof of the crime, when the present law of England demands only proof of pene-

tration, and not of *emission*. Thus, a rape may be legally completed without reference to emission; and, medically speaking, it appears quite possible that there might be emission without any penetration. Admitting that certain stains of this description are found on the clothes of an accused party,—Are these to be taken as furnishing undeniable proof of the legal completion of rape? It appears to me that without corroborative proofs from the state of the female organs they cannot be so taken; and, therefore, the affirmative evidence from the microscope, under these circumstances, is as liable to lead to error as that which is purely negative. The fact that spermatic stains are found on the linen of the prosecutrix may, however, become occasionally of importance in assaults; as the following case, which was tried at Edinburgh, Nov. 27th, 1843, will show. (*Reg.* v. *Hamilton.*) The prisoner, who was at the time labouring under gonorrhœa, was charged with a criminal assault on a child. The shift worn by the prosecutrix, with other articles belonging to the prisoner, were submitted to Mr. Goodsir and Dr. Simpson for examination. Some of the stains on the linen were of a yellow colour, and were believed to be those of gonorrhœa; others, characterized by a faint colour and a peculiar odour, were considered to be stains caused by the spermatic secretion. Digested in water, they yielded a turbid solution of a peculiar odour; and when submitted to a powerful microscope, spermatozoa were detected. The majority of them were mutilated, the long slender filaments being broken off; but perfect specimens were seen, which differed from the living spermatozoa only in being motionless. The stains on the linen of the prisoner and the prosecutrix were similar. The prisoner was convicted of an assault with intent to ravish, and transported for fourteen years. (Cormack's Edinburgh Journal, April, 1844.)

The zoosperm, or spermatozoon, has a flattened, oval, and perfectly transparent body, terminating in a filiform tapering tail, which together measure from 1-500th to 1-600th of an inch. (Curling, op. cit. 38.) It has been already stated that these bodies are the chief characteristic of the healthy spermatic secretion. They are not found in the very young, in the very old, or in those who are labouring under long-standing disease. They have been considered to be independent animalcules; but Müller and other physiologists deny this. (Recent Advances, by Baly and Kirkes, 43.) They move for many hours out of the body when kept at a normal temperature, and even retain their rapid motions when the spermatic liquid is mixed with water; but these motions cease immediately on the addition of urine. According to these physiologists the zoosperms may retain vitality in the body of a female for a period of seven or eight days (p. 610.)

Analysis of stains.—In order to detect the zoosperms, Dr. Hassall recommends that the stained linen should be digested in serum or albumen. M. Bayard employs water gently warmed, and continues the maceration for some hours. It is important that the linen should not be rubbed or handled roughly, as the forms of the zoosperms would be thereby broken down and destroyed. The aqueous solution should be filtered, and a small quantity of the deposit left on the filter, placed in the field of a powerful microscope, when the zoosperms will be seen of the form above described. This, when observed, is a clear proof of the presence of the spermatic secretion: there is no other test, chemical or physical, which can be applied to the detection of it. It is worthy of remark, that the zoosperms in the different species of mammalia differ in size and shape; but there are none which precisely resemble those formed in the human secretion. Dr. Hassall states that he has detected, by the microscope, zoosperms in stains six weeks old (Micros. Anat. vi. 205;) and M. Bayard has been able to detect them in stains after six years! (Man. Prat. de Méd. Lég. 277.) M. Donné, an excellent microscopist, states, on the other hand, that he has never been able to procure satisfactory evidence of the presence of these zoosperms in stains which have become *dried*. He believes that the fine rounded fibres of the stuff (linen) might be very easily mistaken for them. (Cours de Microscopie, p. 304.) This is an im-

portant objection, and it shows that microscopical evidence should be received with caution, and only from persons well versed in the use of the instrument.

Microscopical evidence from the female.—It may become necessary to determine whether intercourse has or has not recently taken place. All observers agree that within a certain period after connexion the fact may be established by the examination of the vaginal mucus. A small quantity of this placed upon glass, and diluted with water, will be found to contain zoosperms, if the suspicion be correct. M. Bayard states that he has thus detected them in the vaginal mucus of females, not subject to morbid discharges, at various intervals up to three days after intercourse (op. cit. 277;) and Donné found them under similar circumstances in a female who had been admitted into the hospital the day before. (Op. cit. 305.) This evidence may become of great value in a charge of rape; but it may be destroyed by the presence of leucorrhœa: and it is open to an objection, that in certain morbid states of the vaginal mucus of the human female, there is found in it an infusory animalcule, called by Donné the *Trichomonas vaginæ*. This has a larger body, and a shorter tail, than the zoosperm; but the witness who trusts to the use of the microscope on such occasions, may be fairly asked, whether he is able to distinguish the spermatozoa from the trichomonades. They who are not used to microscopical investigations may be easily deceived, especially when the spermatozoa are dead and mutilated.

Marks of blood.—Marks of blood upon the linen can, of course, furnish no evidence unless taken with other circumstances. The linen may be intentionally spotted or stained with blood for the purpose of giving apparent support to a false accusation. Dr. Bayard met with a case of this kind, in which a woman charged a youth with having committed a rape upon her infant child. On examination, the sexual organs were found uninjured; and on inspecting the marks of blood on the clothes of the child, it was observed that the stains had been produced on the *outside*, and bore the appearance of smearing. The whole fibre of the stuff had not even been completely penetrated by the liquid. These facts established the falsehood of the charge. (Ann. d'Hyg. 1847, ii. 219.) It may be a question whether the marks of blood on the linen of the prosecutrix were caused by effusion as a result of *violence*, or by *menstrual discharge*. The menstrual fluid in the *normal* state is said to be entirely free from *fibrin;* but in respect to the red colour, the presence of red corpuscles, and of serum, the two kinds of blood are similar. That fibrin is frequently present, and in large quantity, in the menstrual blood, is obvious from its being occasionally discharged in a clotted state: hence the discovery of fibrin in the stain would by no means necessarily imply that the blood was from a wound, and not due to menstrual discharge, while its non-discovery would not prove the blood to be menstrual. Small quantities of fibrin are not readily separable from linen stained by blood as a result of effusion; and supposing the stain to have been caused by imbibition from another article of dress already stained, the secondary stain would be free from fibrin, which would remain in the stuff originally wetted. A man might thus wrongly pronounce this secondary stain to be due to menstrual blood. Even the discovery of epithelial scales and mucus, by the microscope, would not prove the stain to be menstrual, unless it could be shown that the mucus was effused with the blood which caused the stain. (See ante, p. 222.) It may be right to state, for the information of medical practitioners who have hitherto thought that they could very easily distinguish menstrual blood and swear to it, on charges of rape, that a few years since, the French Academy of Medicine appointed as a committee, MM. Adelon, De Lens, Moreau, and Le Canu, to examine this question in the most comprehensive manner. These gentlemen reported that, in the present state of science, there is no method by which menstrual blood can be distinguished from that effused from the blood-vessels in a case of infanticide or abortion. Ann. d'Hyg. 1846, i. 181.)

Evidence of violation in the dead.—Sometimes the body of a female is found

dead, and a medical witness is required to determine whether her person has or has not been violated before death. There is here some difficulty, because there will be no statement from the prosecutrix herself. The witness can seldom do more than express a conjectural opinion from the discovery of marks of violence on the person and about the genital organs. Even if spermatozoa were detected in the liquid of the vagina, this would merely prove that there had been intercourse; whether violent or not, must depend on circumstantial evidence.

Legal relations.—The statute-law which refers to this crime is the 9 Geo. IV. c. xxxi. s. 17, 18. According to the eighteenth section, "Carnal knowledge shall be deemed complete upon *proof of penetration* only." The words are, perhaps, not sufficiently precise; for by one judge, the law was thus interpreted; Carnal knowledge, *i. e.* penetration, is not complete, unless the hymen be ruptured. This, as it has been suggested, would divide penetration into vulval and vaginal, the former not constituting rape, but a common assault. The majority of the judges, however, have not admitted a distinction of this kind. They have strictly adhered to the obvious and literal meaning of the words of the law, and have regarded the rupture of the hymen, not as a necessary proof, but as strong evidence of penetration. The question of penetration is not for the medical witness, but for the jury to decide from the whole of the facts. In the case of a child, the prisoner was seen perpetrating the act, but it was proved that the hymen, which was normally placed, was not ruptured; yet this case was decided like that of *Rex* v. *Russen:* the crime was considered to be complete. Thus, then, when the material evidence of penetration (rupture of the hymen) is wanting, proofs may be derived from other and non-medical sources.

[In New York, Pennsylvania, Virginia, New Jersey, Vermont, and New Hampshire, the punishment for rape is imprisonment for a long period, with or without fine, as the particular law may direct.

In Louisiana it is imprisonment for life, and in Massachusetts, Rhode Island, Delaware, and South Carolina, it is a capital offence. In Tennessee, Alabama, and Louisiana, a rape, or attempt at rape, by a coloured man on a white woman is also punishable by death; whilst in Virginia and Missouri the same is punished by castration.

Although rape is defined to be a carnal knowledge of a woman against her consent, by force, menace, or fraud, of such a character as to deprive her of her power of resistance, there has, as stated in the text, been much diversity of opinion as to what constitutes the carnal knowledge. In some of our states, as Pennsylvania, New York, Illinois, and Louisiana, Tennessee and Indiana, penetration is held sufficient in all but the first by special enactment, in the others by decisions. In some of the other states, however, acquittals have taken place from want of proof of the occurrence of emission. Vide last Am. ed.—H.]

Rape by females on males.—So far as I can ascertain, this crime is unknown to the English law. Several cases of this kind have, however, come before the French Criminal Courts. In 1845, a female, aged 18, was charged with having been guilty of an act of indecency, with violence, on the person of Xavier T., a boy under the age of 15 years. She was found guilty, and condemned to ten years' imprisonment. In another case, which occurred in 1842, a girl, aged 18, was charged with rape on two children,—the one 11, and the other 13 years of age. It appeared in evidence that the accused enticed the two boys into a field, and there had forcible connexion with them. This female was proved to have had a preternatural contraction of the vagina, which prevented intercourse with adult males. She was found to be labouring under syphilitic disease; and the proof of her offence was completed by the disease having been communicated to the two boys. She was condemned by the Court of Assizes of the Seine to fifteen years' hard labour at the galleys. (Ann. d'Hyg. 1847, i. 463.) By the penal code of France, it is a crime in either sex to attempt intercourse with the other, whether with or without violence, when the child is under eleven years of

age. That this offence is perpetrated in England cannot be doubted. It is by no means unusual to find in the wards of hospitals, mere boys affected with the venereal disease. In some instances this may be due to precocious puberty; but, in others, it can only be ascribed to that unnatural connexion of adult females with mere children, which is punished as a crime in the other sex. The only accessible medical proof would consist in the transmission of gonorrhœa or syphilis from the woman to the child.

Sodomy. Bestiality.

This crime is defined, the unnatural connexion of a man with mankind or with an animal. The evidence required to establish it is the same as in rape, and therefore penetration alone is sufficient to constitute it. There are, however, two exceptions: it is not necessary to prove the offence to have been committed against the consent of the person upon whom it was perpetrated; and 2dly, both agent and patient (if consenting) are equally guilty; but the guilty associate is a competent witness. In one case (*Rex* v. *Wiseman*,) a man was indicted for having committed this offence with a woman, and a majority of the judges held that this was within the statute. Unless the individual be in a state of insensibility, it is not possible to conceive that this offence could be perpetrated on an adult of either sex against the will of the party. The slightest resistance will suffice to prevent its perpetration. In August 1849, a question on this point was referred to me from Kingston, Jamaica. A man was convicted, and sentenced to transportation for life, for the crime of sodomy, alleged to have been committed on the complaining party while he was asleep. The only evidence against him was the statement of the complainant. The opinion given was in conformity with that of Dr. J. Ferguson, who referred the case to me, namely, that the perpetration of the act during a state of natural sleep was contrary to all probability. If the crime be committed on a boy under fourteen years, it is felony in the agent only; and the same, it should seem, as to a girl under twelve. (Archbold, 409.) The act must be in the part where it is usually committed in the victim or associate of the crime, and if done elsewhere it is not sodomy.

The facts are commonly sufficiently proved without medical evidence, except in the case of young persons, when marks of physical violence will in general be sufficiently apparent. In some cases, proof of the fact may be obtained by resorting to microscopical evidence. (See Donné, op. cit. 305.) Trials for this crime are very frequent, although it was not, like rape, specially excepted from capital punishment by the 4th and 5th Vict. cap. lvi. It is also said to be on the increase. (Law Times, Jan. 4th, 1845.) There cannot be the slightest doubt that false charges of this crime are more numerous than those of rape, and that this is too often a very successful mode of extortion. This is rather a legal than a medical question: but it is especially deserving of notice, that these accusations are most frequently made by soldiers and policemen!

ASPHYXIA.

DROWNING.

CHAPTER LVII.

DROWNING—CAUSE OF DEATH—DEATH NOT CAUSED BY APOPLEXY—ASPHYXIA—MIXED CASES—DEATH FROM SECONDARY CAUSES—PERIOD AT WHICH DEATH TAKES PLACE—PERIOD FOR RESUSCITATION—CASES OF RECOVERY—TREATMENT—POST-MORTEM APPEARANCES—RIGIDITY AND SPASM IN THE DROWNED—EXTERNAL AND INTERNAL APPEARANCES—WAS DEATH CAUSED BY DROWNING?—SUBSTANCES GRASPED IN THE HANDS—WATER IN THE STOMACH—MUCOUS FROTH IN THE TRACHEA AND LUNGS—WATER IN THE LUNGS—DESTRUCTION OF POST-MORTEM APPEARANCES—SPECIFIC GRAVITY OF THE HUMAN BODY LIVING AND DEAD—SURVIVORSHIP OF THE DROWNED—SUMMARY OF MEDICAL EVIDENCE—MARKS OF VIOLENCE ON THE DROWNED—ACCIDENTAL FRACTURES—WAS THE DROWNING THE RESULT OF HOMICIDE, SUICIDE, OR ACCIDENT?—DROWNING IN SHALLOW WATER—BY PARTIAL IMMERSION OF THE BODY.

The cause of death.—Many opinions have been entertained respecting the manner in which death takes place by drowning. It was at one time supposed that the water which passed into the stomach of a drowning animal had an injurious effect, and operated as the immediate cause of death. This opinion prevailed before the importance of the respiratory process in the economy was fully understood. It would, however, have been easy to show the insufficiency of this explanation by a simple appeal to facts. Water is not invariably found in the stomachs of the drowned; and again, it may be introduced into the stomach in much larger quantity than we are accustomed to meet with it in the body of a drowned person, without producing any deleterious effect. The presence of water in the bronchial ramifications of the lungs has been suggested as the probable cause of death: it was thought that it operated here by arresting the circulation of blood in the minute pulmonary vessels. This explanation of the cause of death in drowning would imply that water was always present in the lungs of the drowned, which, however, is not the case: and, indeed, when found, it is often met with in small and variable quantity; facts which sufficiently show that this hypothesis cannot be entertained. The spasmodic closure of the glottis tends to prevent the entrance of water into the trachea. Death has been also attributed to collapse of the lungs, by which the blood is presumed to be mechanically prevented from traversing the pulmonary structure. It is a generally admitted fact, that a considerable quantity of air is, in most cases, expelled from the lungs during the act of drowning, but these organs are not commonly found collapsed in drowned animals; and when this condition is observed, it is rather to be regarded as a consequence, than a cause, of death.

Death not caused by Apoplexy.—Some have ascribed death in drowning to a congested state of the cerebral vessels,—in other words, they conceive that death

takes place in most cases by a species of apoplexy. That a congested state of the cerebral vessels is often met with in the bodies of the drowned, is a fact which cannot be disputed; but the same degree of congestion is observed, not only in other cases of asphyxia, but also in the inspection of bodies where death has proceeded from various causes unconnected with cerebral disturbance. There is no ground, therefore, for attributing death to an apoplectic attack;—a mere fulness of the cerebral vessels is certainly of itself insufficient to justify this view, for upon the same evidence we might pronounce three-fourths of those deaths which are distinctly referrible to other causes, to be dependent on apoplexy. The obstruction to the passage of the blood through the lungs is sufficient to explain why we meet with a sanguineous congestion in the cerebral vessels of drowned subjects; and there is great reason to believe that the occurrence of this congestion is posterior to the interruption of the cerebral functions. The most characteristic post-mortem appearance of apoplexy—extravasation of blood—is rarely seen in the drowned; and probably, where it exists, it might be traced to mechanical violence before submersion, or to the head coming in contact with hard bodies beneath the water. I have met with only two instances reported, where extravasation of blood on the brain was found:—the one was in the case of Leopold, Duke of Brunswick, who was drowned in the Oder, during the German war (see Henke, Gericht. Med. 327,) and the other was a case which occurred in London in 1839. In general, the term apoplexy is applied to those cases of drowning where there is great fulness of the cerebral vessels; but, in most of these, there are also signs of death from asphyxia.

Asphyxia.—No doubt now exists among physiologists that death by drowning is due to asphyxia or suffocation, in which condition the blood is either circulated in a state unfitted to support animal life, or its circulation through the minute vessels of the lungs is wholly arrested. The latter view is now more commonly adopted, and to this arrest of the pulmonary circulation may be ascribed the gorged or congested condition of the lungs of the drowned when death has really taken place from asphyxia. The observations of Sir B. Brodie (Lectures on Pathology, 66) and others, clearly prove, however, that the circulation may be carried on for two or three minutes after respiration has ceased, so that there is not a sudden cessation of the heart's action. Asphyxia is induced in drowning, owing to a physical impediment to the introduction of air, and we have, therefore, in this form of death, a simple illustration of this state. The medium in which the individual is immersed acts mechanically and as effectually as a rope or ligature around the neck; for although air escapes from the lungs, and water may penetrate into the minute air-tubes, yet no air can enter to supply the place of that which has already expended a certain quantity of its oxygen on the blood. Hence this fluid must circulate, if it circulate at all, in a state unfitted for the support of existence, and death will ensue. When an individual falls into water, and is exposed to this kind of death, vain attempts are in the first instance made to respire. At each time the drowning person rises to the surface a portion of air is received into the lungs, but owing to the mouth being on a level with the liquid, water also enters and passes into the fauces. A large quantity of water thus usually passes into the mouth, which the individual feels himself irresistibly compelled to swallow. The struggle for life may continue for a longer or shorter period, according to the strength of the person, but the result is, that the blood in the lungs becomes imperfectly aerated, and exhaustion follows. The mouth then sinks altogether below the level of the water, air can no longer enter into the lungs,—a portion of that which they contain is expelled, and rises in bubbles to the surface: an indescribable feeling of delirium, with a ringing sensation in the ears, supervenes,—the person then loses all consciousness, and dies asphyxiated. Before death, and while the body is submersed, frequent attempts are made to breathe, but at each effort air escapes from the lungs, so that these organs may, according to the duration of the struggle, become partially emptied

and be found collapsed after death. The action of the heart continues for a few minutes after the lungs have ceased to act,—dark-coloured blood is circulated,—convulsive motions of the body follow, and the contents of the stomach are sometimes ejected prior to dissolution. There is not the least sensation of pain, and, as in other cases of asphyxia, if the individual recover, there is a total unconsciousness of suffering during the period when the access of air was cut off from the lungs. I state this from having accidentally experienced all the phenomena of drowning up to the complete loss of sensibility and consciousness. (See in reference to this form of asphyxia a paper by Mr. Eccles, Med. Gaz., vol. xliv., page 657.)

Some persons who fall into water are observed to sink at once without making any attempt to extricate themselves. This may arise from the stunning produced by the fall; and if the fall take place from a great height, the effect is probably aided by the forcible compression which the thorax then sustains, whereby the lungs become in great part emptied. Should the person be intoxicated or otherwise incapacitated, as by striking his head in falling, he may not again rise. These different conditions under which death may take place will sufficiently account for the great difference in the appearances met with in the bodies of those who have died under these circumstances. Some medical jurists have considered that they who are submerged while living, frequently perish by *syncope*, and in other instances by what has been termed syncopal asphyxia—a mixed condition. It has been supposed that the state of terror into which a person may be thrown prior to submersion, would be sufficient to bring on syncope; and this, it was presumed, offered an adequate explanation of the recovery of the apparently drowned, when the body had remained a long time in water. It may readily be admitted that in some instances the mental shock may be so great to a person falling into water as to induce syncope; but it is impossible to determine how often this occurs, and its occurrence appears to be founded rather upon presumption than upon actual observation.

Mixed cases.—It is obvious that they who die from apoplexy, concussion, or syncope, at or about the time they fall into water, cannot be said to die from drowning. An individual so situated makes no effort to respire, and it is only by interfering with respiration that the water operates. Admitting, then, that in strictness *asphyxia* is the sole cause of death in drowning, these mixed cases are of interest in medical jurisprudence only because the apparent may be mistaken for the real cause. It may be occasionally necessary to determine whether the person really die by drowning or not, *i. e.*, whether he was asphyxiated by water or not; since an answer to this question may materially affect the position of a prisoner charged with homicide. The only conclusion at which we can arrive is, that many persons may fall into water, and appear to be drowned, whose deaths have actually preceded their submersion. They may have died from fright or terror at their situation, or have been killed by their heads coming accidentally in contact with hard bodies during the fall, or even with the surface of water itself; for this may be sometimes sufficiently resisting to produce concussion of the brain, when the fall is from a great height, and the head comes first in contact with the water. It is probable that some also perish owing to a shock received at the pit of the stomach by the violence of the fall. A shock thus received in the region of the heart might possibly suspend the functions of that organ, and kill the person by inducing sudden syncope. A case is mentioned in the Dublin Medical Journal, for May, 1837, which appears to bear out this view. Again, there may be extensive but latent disease of the heart, which may fully account for sudden death irrespective of submersion. (See case in Lancet, Nov. 16, 1850, p. 550.) [Dr. Brownsègnard attributes death in the asphyxia or apnœa of drowning to the immediate accumulation of carbonic acid in the blood, and to the rapidly exhausting excitation of the heart and brain produced by the stimulant action of the accumulated acid upon these organs.

This theory will account for many of the deaths from secondary causes, also for the fatal termination in what has been called secondary asphyxia after temporary hanging, or strangling and suffocation, as well as drowning. (See Philad. Med. Ex. 1852.)—H.]

Death from secondary causes.—Drowning may operate indirectly as the cause of death. Thus it has been repeatedly remarked that persons who have been rescued from water in a living state have died in spite of the application of the usual restoratives, after the lapse of some minutes or hours; others have lingered for one or two days, and then have sunk apparently from exhaustion. In those who perish soon after removal from the water, death may arise from the exhaustion produced by the struggles of the individual for life, aided by the long contact of the body with a cold medium. When death takes place at a remote period, it may be due to disease, and the question will then be, whether the disease was produced by the immersion in water or not. Such cases occasionally present themselves before our Courts of Assize. In one of these (*Reg.* v. *Pulham*, Gloucester Summer Assizes, 1845,) the prisoner was charged with the death of the deceased by pushing him into a pond of water, from the effects of which he died. The deceased was an old man; he was taken out of the water in a very exhausted condition, and died five weeks afterwards. One medical witness referred death to the effects of the immersion; but as he had not attended the deceased after the violence, and there was no clear account of the cause of death, the prisoner was acquitted. In most of these cases it will be found exceedingly difficult to connect death with the immersion, when the fatal result does not take place until after so long a period. We must rely upon the nature of the disease alleged to have been caused by immersion,—*e. g.* inflammation of some cavity or organ, and its progress until death without intermediate recovery or interference by improper treatment,—as the basis of our evidence.

According to M. Devergie (Méd. Lég. ii. 336,) of one hundred individuals who fall into the water, or are exposed to the chances of drowning, the following may be taken as the numerical ratio of the causes of death:—

Asphyxia, pure	25·0		
——— and Syncope . . .	62·5	Asphyxia . . .	87·5
——— Cereb. Congestion .			
Syncope, Apoplexy, or Concussion			12·5
			100·0

From this table we learn that out of one hundred bodies removed dead from water, where death was due either directly or indirectly to immersion,—if the body were removed immediately after death and examined soon after removal, the signs of drowning would be present in about 25:—they would be imperfectly apparent (asphyxia more or less marked) in about 62, and they would be wholly absent in about 12. This table may not represent the actual truth, but as the medical jurists of Paris have ample opportunities of examining the drowned, it is probably as near an approximation as the present state of science will permit us to reach. (For a full examination of the causes of death in drowning, by Dr. Loeffler, see Henke, Zeitschrift der S. A. 1844, i. 1.)

Period at which death takes place.—A witness may be asked how long a time is required for death to take place by drowning. In giving an answer to this question, it must be remembered that all who fall into water, and are exposed to the risk of drowning, do not really die by this kind of death. Thus all cases of death from syncope or apoplexy must be excluded from our consideration. Again some persons who are strong, who are good swimmers, and retain their presence of mind, may support themselves for a length of time in water, while others who are weak and delicate may struggle only for a few seconds, and then sink exhausted and lifeless. There are two very different points involved in this

inquiry:—1. How long can a person remain beneath the surface of water without becoming asphyxiated (drowned?), and 2. After what period of entire submersion of the body may we hope to resuscitate a person? In regard to the first point, it may be remarked, that when the mouth is so covered that air cannot enter, asphyxia supervenes in the course of one or two minutes at the farthest, and the time at which this occurs does not appear to vary materially with the individual. It has been observed that perfect insensibility has supervened after a minute's submersion, and it is probable that in most cases a few moments would suffice for the commencement of asphyxia. In the case of a healthy diver who was accidentally submersed, at Spithead, in July, 1842, for a *minute and a half*, without the power of breathing, at the depth of eighty feet, it was observed that when drawn up he was faint but sensible. (Med. Gaz. xxxi. 90.) Observations made upon sponge and pearl-divers show for how short a period a human being, even when practised in the art of diving, can continue without breathing. Dr. Lefevre, of Rochefort, found that among the Navarino sponge-divers, accustomed as they were to the practice of diving, there was not one who could sustain entire submersion of the body for *two consecutive minutes*. The average period of entire submersion was seventy-six seconds. (Med. Gaz. xvi. 608.) According to Mr. Marshall, the best pearl-divers of Ceylon could rarely sustain a submersion of more than fifty seconds. Thus, then, it would appear from these and other observations, that asphyxia is probably induced in most individuals in the course of a few seconds, and that at the furthest it occurs in from a minute to a minute and a half.

Period for resuscitation.—The second point to be considered is—how long a period of entire submersion is required for death to take place, *i. e.* when is there no further hope of resuscitating a drowned subject? This question is of great importance in relation to the treatment of the drowned. The insensibility which is the result of submersion will give to a body which has been immersed only a few minutes or even seconds, the characters of apparent death; but we are not, therefore, to desist from applying all the means in our power to restore animation. On the contrary, it is only a proper act of humanity that the means should be applied without delay, even to subjects which have remained so long in water as to afford, physiologically speaking, but little hope of ultimate resuscitation. A man who would neglect the application of these would consign the body to certain death, while, by adopting an opposite course, he might, perhaps, unexpectedly to himself, succeed in restoring a fellow-creature to existence. Hence we are not to allow ourselves to be influenced, in the treatment of the drowned, by the shortness of the period at which death most commonly takes place; for it is possible that two individuals may be drowned under the same circumstances, and treated, on removal from water, in the same way; yet the means of resuscitation will be effectual in one case, while they may totally fail in the other. It ought to be borne in mind that the susceptibility to the restoration of life may be different in the two subjects: were this not the case, it would be impossible to explain why, under the most judicious treatment, every effort will fail in restoring animation in a subject which has been submerged only two minutes, while the same means will perfectly succeed in resuscitating another subject which may have been submerged five or even ten minutes. Devergie states that it has been found impossible to restore some who had not been entirely submerged for more than *a minute*, and when the bodies were removed with all the warmth and pliancy of life about them; but, on the other hand, others have been resuscitated who, there was reason to believe, had been *entirely* submerged for five minutes. It is necessary that these circumstances should be clearly explained; for many of the marvellous recoveries reported have no doubt been cases of the resuscitation of individuals who had not been entirely submerged, *i. e.* with the head below water, for the period alleged. If we are called upon to state physiologically, how we can reconcile the accounts of resuscitation after

the body has remained for a quarter of an hour or even for a longer period, in water, with the fact of the general occurrence of death within the short interval of a few seconds or minutes from the time of submersion, we must look upon such accounts, provided their authenticity be placed beyond all doubt, as extraordinary exceptions to a very widely-extended rule. It is necessary to observe that the head of the subject may not have been under water during the whole of this time; the individual may have struggled long, and have risen frequently to the surface, or the upper part of his body may have received support from some mechanical obstacle. All these circumstances, as well as the depth of the water in which the body is found, should be duly considered before we proceed to admit statements which are opposed to facts well established by experiment and observation. In most of the cases on record the evidence has been derived from ill-informed and ignorant persons, who were but little fitted to convey accurate information upon so important a question, and whose opinions we should be extremely cautious in receiving. Besides, the period of submersion has been stated upon conjecture, not upon actual observation of the time.

Recovery after submersion for long periods.—The following facts may, it appears to me, be relied on, in relation to this question. Mr. Woolley, a medical assistant of the Royal Humane Society, has met with only one case in the Records of the Society, in which the individual was resuscitated after *five minutes'* submersion (Lancet, Oct. 1841.) In the Report of the R. H. Society for 1840, there were two cases of successful resuscitation after one minute and a half,—and two cases after three entire minutes' submersion. In a case communicated to me by Mr. Bloomfield, in 1841, a boy recovered after a submersion of from five to ten minutes. In another, communicated to the Lancet by Mr. Smethurst (July, 1841,) a girl aged two years recovered after ten minutes' immersion—it is not quite certain whether, in this instance, the head was under water during the whole of this time. A case of recovery after six minutes' alleged submersion will be found in the Med. Gaz. (xxix. 78:) and in a case communicated to the Medical Times (Dec. 2, 1848, p. 125,) by Dr. Octavian Royle, it was inferred that there was partial recovery after a submersion of at least eight, and probably thirteen minutes. In vol. xxxi. p. 448, of the Med. Gaz., is perhaps one of the most remarkable of these cases, where an individual is stated to have been resuscitated after *fourteen minutes'* submersion; and the case carries with it great probability, although the time was derived rather as a matter of calculation from circumstances than from actual observation. This is the longest authentic period with which I have been able to meet. Cases of alleged recovery after half an hour, and even three quarters of an hour, will be found reported: some have endeavoured to explain these by assuming that the individuals in question were restored from a form of syncope which had occurred in consequence of the mental shock experienced at the moment of submersion. It has been admitted that syncope may occur under these circumstances, and it is possible also that the susceptibility of resuscitation may remain longer in a subject labouring under syncope, than in one who has perished by asphyxia; but the question here obviously presents itself, whether the lungs can cease to act, and the heart to circulate blood, for the period of half an hour, consistently with the maintenance of life. The medical jurist must remember, that neither of these functions can continue when the body remains entirely submerged; for it is impossible that air can enter into the lungs, and we know that the circulation, provided syncope be not previously induced, is not maintained above three or four minutes in a person so situated. There are few, indeed, who would be disposed to admit that respiration and circulation could remain so long entirely suspended in any individual, whether he be in a state of syncope or asphyxia, without the complete destruction of life, or if they did admit the possible occurrence of so great a deviation from the common phenomena of vitality, they would require better evidence for such an admission than that by which these cases are usually supported. In

numerous experiments on drowned animals, I have never found that life could be restored after the animal had remained entirely submerged for the space of four minutes. In one case, where a stout healthy man had been submerged five minutes, and every means for resuscitation speedily used, the result was unfavourable. We are, then, bound unhesitatingly to declare, that in drowning, life is very speedily destroyed,—that the time within which resuscitation may be successfully attempted is subject to variation,—and, lastly, that the cases which have been hitherto recorded of restoration after lengthened submersion of half an hour and upwards, are to be regarded as extravagant fables. I am glad to be supported in these views by the observations of so experienced a writer as Sir B. Brodie. (Lectures on Pathology, 90.)

[The researches of M. Bronsègnard would seem to show that vital action may continue no longer in water of a low temperature than it will in water of a more moderate one, as the effect of cold is to retard the excitation of the heart and cerebro-nervous system, which in asphyxia, or forced apnœa, exhausts the powers of life. (See Phila. Med. Ex. 1852.)—H.]

Treatment.—A question has often arisen at coroners' inquests whether death may not have been really due to neglect in the treatment. The principles to be observed are, 1. To wipe the body dry. 2. To keep the head and shoulders raised. 3. To restore the warmth of the body. This may be done, according to the means at hand, by warm blankets, bottles of hot water, bags of hot sand or salt, the warm water-bath, or the warm air-bath. (For an account of the latter, see Med. Gaz. Sept. 1838.) The warmth should be especially applied to the feet and abdomen. 4. The cautious application of stimulants, such as diluted ammonia, to the nostrils. 5. Having cleared the mouth and fauces, we should move the chest, in order to simulate the act of respiration. 6. The employment of stimulating embrocations, such as the Lin. Camph. Com. rubbed by a warm flannel on the trunk and the extremities. It is not advisable to employ venesection until signs of recovery appear, nor even then unless this treatment should be indicated by great cerebral congestion. Much difference of opinion exists on the propriety of introducing air into the lungs by artificial processes. Mr. Woolley, who has had considerable experience in the treatment of the drowned, denies its efficacy (Med. Gaz. xvii. 663,) and states that in the cases in which he had been successful in resuscitating them he had not inflated the lungs. This is certainly strong evidence against the alleged necessity for the practice, and it is corroborated by the observation of Dr. Douglass (Med. Gaz. xxxi. 449,) in one of the most remarkable cases of resuscitation on record; for the individual here had been *fourteen minutes under water*, and no signs of returning animation were evinced, until the treatment—which consisted simply in the application of warmth and constant friction—had been persisted in for eight hours and a half from the time of the accident! Inflation of the lungs was tried, but not persisted in, as, while it did not appear to be attended with any good effect, it interfered with the rubbing, on which the greatest dependence was placed.

Artificial inflation is, however, commonly used, and it is said successfully;—but other means, under which alone the apparently drowned have often recovered, have been simultaneously employed; so that it is rather difficult to say what share the inflation may have had in the recovery. Certainly it should never be allowed to interfere with the application of those means by which *warmth* is restored to the skin. M. Marc states that more good is done by drawing air out of the lungs than by artificially inflating the organs. His experience was against the latter practice. Theoretically speaking, artificial inflation appears to be strongly indicated. Dr. Harvey considers it to be the best mode of treatment (Med. Gaz. xxxvi. 897;) and Mr. Bloomfield informs me that he has found it to be a most effectual plan to introduce air by applying the mouth to the mouth of the deceased. A very ingenious apparatus for performing artificial respiration has been contrived by Dr. Sibson. (Med. Gaz. xli. 271.) This should super-

sede the old plan of the bellows, or of a tube introduced into the nostrils. (Brodie's Lectures on Pathology, 78.) In employing any of these methods, the larynx should be pressed against the œsophagus and spine, and the artificial respirations should be renewed at about the same intervals as the natural respiration; *i. e.* about sixteen in a minute, and the same quantity of air, as nearly as possible, should be introduced each time, as would be respired naturally. Too much force must not be employed, or the lungs will be injured. In all cases, the mouth and fauces should, in the first instance, be cleared of mucus and froth. Electricity, and electro-magnetism to the spine and the region of the heart, have been recommended; but the obvious objection is, that the means are not commonly at hand, and whatever is done on these occasions must be done quickly. Many years since, Dr. Durrant advised the employment of oxygen (Med. Gaz. xxv. p. 848;) and if the gas were ready for use there would be a good prospect of success. Dr. Wilson has suggested that it may be readily procured by heating a mixture of five parts of powdered chlorate of potash with one part of powdered red oxide of iron. It has been long known that the chlorate mixed with one-eighth of its weight of oxide of manganese, readily evolves oxygen. These powders may be kept ready prepared in well stoppered bottles. (Med. Gaz. xxxvi. p. 434.)

Although the individual may have been only one minute submerged, if much time has elapsed before the means for resuscitation are employed, there can be no hope of success. It has been stated that, after ten or fifteen minutes' submersion, there is but little hope of recovery; yet these attempts at restoring animation often fail from the delay which ensues in obtaining the means. Thus there will be a better chance of recovering one who has been five minutes submerged, where the treatment is immediate, than another who may have been only two minutes submerged, but where a delay of from ten to fifteen minutes has occurred in the application of the means. This obstacle to recovery is often overlooked,—attention being paid to the period of submersion only. On these occasions we should not be justified in declining to employ the means of resuscitation, merely because the body was cold and apparently lifeless. Another point to be considered is, for how long a period should the efforts at restoration be continued. When the treatment is commenced under circumstances which justify a fair hope of success, it would be proper to continue the treatment for at least *an hour*. In Mr. Bloomfield's case, an hour and a half elapsed before there were any signs of returning animation. In Dr. Douglass' case, resuscitation began to be only feebly established after eight hours and a half spent in the treatment! There is no doubt that this case would have been abandoned as hopeless by many long before this period, especially as the man had been submerged fourteen minutes; and thus, perhaps, many persons are lost who might be recovered by perseverance. The tendency to restoration is often evinced by the occurrence of slight lividity in the face, with convulsive twitchings in the facial muscles; and before recovery takes place there are sometimes convulsive movements of the limbs and trunk. In Paris, from 1821 to 1826, out of five hundred and seventy-six cases of drowning, four hundred and thirty were resuscitated.

Post-mortem appearances.—In conducting the examination of the body of a drowned person, it is necessary to remember that the external and internal appearances will vary much, according to the length of time during which the body may have remained in the water, or the period which may have elapsed after its removal and before it is examined. Two subjects may be taken out of water at the same time—one may be examined immediately, while the examination of the other may be deferred for several days. In these cases the post-mortem appearances will be no longer similar; and the differences will be particularly great when the last-mentioned body has been exposed to a high temperature and to the free access of air.

External appearances.—Supposing that the body has remained in the water

only a few hours after death, and the inspection has taken place immediately a its removal, the *skin* will be found cold and pallid—sometimes contracted unde the form of cutis anserina. (Ed. Med. and Surg. Jour., Jan. 1837.) It is often covered to a greater or less extent by livid discolorations. The face is pale and calm, with a placid expression, the eyes are half open, and the pupils dilated; the mouth closed or half open, the tongue swollen and congested, frequently pushed forwards to the internal edges of the lips, sometimes bitten by the teeth;—and the lips, together with the nostrils, covered by a mucous fluid which oozes from them.

Rigidity and spasm.—The body may be found rigid, and the hands clenched. An important question arose in the case of The *Queen* v. *George* (Hereford last Assizes, 1847), as to whether drowning was likely to produce a convulsive or contracted state of the limbs. The prisoner was indicted for the murder of her infant child, by drowning it. When taken from the water (in the month of December,) about nine days after the supposed murder, there were no marks of external violence. The arms and legs were contracted, and the hands clenched. On inspection, the vessels of the brain were congested, the lungs were collapsed, and there was farinaceous food in the stomach, partially digested. The state of the trachea, and the presence or absence of mucous froth, are not referred to. It will be seen, from this description, that there was no appearance to indicate death from drowning with any certainty, and the medical witness admitted that but for the discovery of the body in water, the suspicion of death from drowning would not have been entertained. From the state of the brain, it might have been referred to convulsions. The defence was, that the child had probably died of convulsions, and that in order to dispose of the body, the prisoner had stripped it of its clothes, and thrown it into the water after death. The medical evidence failed to show that the child had died from drowning, and the prisoner was acquitted.

The contracted state of the child's limbs appeared to create a difficulty in the defence. The clothes of the child were neither cut nor torn, and the medical witness considered, that had the limbs been as contracted as they were when the body was found, they could not have been removed without cutting or tearing. The medical question therefore was, whether the state of the child's limbs did not prove that it had been put into the water while living. As the usual appearances of death from asphyxia were entirely wanting, it is proper to consider whether there may not be some explanation of the facts consistently with death before immersion. The admission made by the witness in cross-examination appears to supply all that is necessary for this explanation. If the child had died of convulsions, if the clothes were then removed, and the body thrown in immediately, the sudden effect of the cold water might have occasioned the contraction of the limbs; or the child may not have been really, but only apparently dead, when the mother stripped it. If some time had elapsed before immersion, so that the body had become cold, then the limbs would have been found either relaxed or stiffened in a straight position. The persistence of the contracted state for so many days may be explained by the immersion having taken place at the coldest season of the year.

In general, when the dead bodies of the drowned are taken from water, the limbs are found relaxed; but this must depend on the period at which they are removed. Rigidity takes place, after death in water, perhaps more rapidly than in air. If the water be intensely cold, and the individual have struggled violently, the last struggles of life may be indicated by the contorted state of the limbs persisting through rigidity. Mr. Beardsley, a former pupil, has communicated to me the following case which he had to examine. A young man, while skating, fell through the ice of a pond about seven yards deep. This was in February, 1847. He was not totally immersed, for he kept his head and shoulders out of the water above the ice, with his arms resting upon it; and in

the ice gave way under his weight, he sprang on to a fresh portion. Before assistance could be rendered, he sank to the bottom. The body was removed the next day: it was found at the bottom of the pond, beneath the hole in the ice. The arms of the deceased were quite stiff, and still retained the position in which he had rested upon the ice: his legs were quite extended, and the muscles on the fore part of the thigh were very much contracted, as if they had been powerfully exerted in keeping him erect while he was hanging on the ice. There was no appearance of his having attempted to breathe after he had gone below the water. His countenance was quite natural,—there was no water or froth in his mouth; and in Mr. Beardsley's opinion, the subject had the appearance of a body immersed after death from some other cause. It does not appear that there was any internal inspection. Mr. Beardsley's opinion was, that the water being about 32°, the man was in reality killed by cold, or frozen; and there is no doubt, that if this did not operate as the direct cause of death, it materially accelerated it.

This case is of interest in reference to a point to be presently adverted to; namely, the fact of drowned persons being often discovered with substances firmly grasped in the hands. A contracted state of the muscles at the time of death may pass into perfect rigidity by the effect of cold water; and thus the attitude, or the last act of life of the individual, may be preserved. It is precisely analogous to what has been called cadaverous spasm.

Changes from putrefaction.—If the body have been submerged for a long period, or have remained long exposed before inspection, the skin will be found variously discoloured, according to the degree to which putrefaction may have advanced. If three or four months have elapsed before its removal from water, the skin covering the legs may be, in the first instance, of a deep blue colour: but when the body is exposed to air, this colour gradually disappears, and the skin becomes brown. The influence of air upon the skin of a drowned subject is most remarkable in the face and thorax. When the body has remained for some days in water, and has been exposed for a few hours only after its removal, the temperature of the atmosphere being moderately high, the face will commonly be found livid and bloated, and the features so distorted that they will be with difficulty recognisable. The change chiefly consists in the skin becoming at first of a livid brown colour, which gradually passes into a deep green. That these effects are to be ascribed to the free contact of air appears evident from the fact that they are most fully developed in those parts of the body which are the most exposed to the atmosphere. Thus, the changes of colour in the skin are not commonly met with where any parts of the cutaneous surface have been in close contact, as in the axillæ and inner surfaces of the upper and lower extremities, where the former have been closely applied to the sides of the trunk, and the latter have remained in close proximity to each other. For the same reason, the discoloration is not commonly observed at the back of a subject, or in those parts where the body has been closely wrapped in clothes.

Abrasions.—There is another external appearance which is sometimes met with in the drowned; the fingers occasionally present abrasions; and gravel, sand, or other substances, may be found locked within the hands or nails of drowned subjects: for in the act of drowning, as common experience testifies, an individual will grasp at any object within his reach, and in his efforts to extricate himself, he may excoriate or wound his fingers. There are, however, many cases of drowning, in which this appearance is absent. There may be no substance for the drowning person to grasp;—this will depend in a great degree upon the fact of the water being deep or shallow, of its being confined within a narrow channel or not, and many other contingencies. In all cases, when the individual is senseless before he falls into water, or when his death is occasioned by syncope from sudden terror, he will, of course, be incapable of making those exertions which are necessary to the production of this appearance. The skin of the palms

of the hands and soles of the feet is found thickened, white and sodden from imbibition, when the body has remained several days in water.

Internal appearances.—On examining the body internally, we may expect to find, in a recently drowned subject, that the viscera of the thorax will present the appearances indicative of asphyxia. The right cavities of the heart, and the vessels connected with them, are distended with blood,—the lungs are sometimes found gorged, and at others pale and collapsed. If death has not taken place from asphyxia, or if the subject has remained a long time in water before the inspection is made, the viscera of the thorax will not present the characters above described. Independently of the changes which may have taken place in consequence of putrefaction, the right cavities of the heart, and the vessels immediately connected with them, may be found collapsed, and generally destitute of blood. Some physiologists have asserted that the *blood* remains fluid in the bodies of the drowned. Orfila observes, that with one exception, he has not met with blood in a coagulated state, in the examination of a drowned person. Much more importance has been attached to this appearance than it really merits. Some observers have found the blood coagulated in the drowned; and I have repeatedly seen coagula, like those usually met with after death, in the bodies of animals which were drowned for the sake of experiment. If the blood be generally found liquid, this may be due to the imbibition of water, or to putrefactive changes. The state of the blood in the drowned formed a subject of inquiry in the case of *Reg.* v. *Barker and others.* (York Winter Ass. 1846.) From the remarks above made, it will be perceived that it may be found either coagulated or uncoagulated in those who go into the water living, and die by drowning. A greater or less fulness of the vessels of the *brain* is described as one of the appearances met with in a drowned subject; but this, when it exists, is probably a consequence of the congested state of the lungs. Some remarks have been already made on this subject, and from these it is evident that the state of the cerebral vessels can afford no presumption that death has taken place by drowning. In regard to the cases which I have had an opportunity of examining, the quantity of blood contained within the cerebral vessels has rarely been so great as to call for particular notice.

In examining the viscera of the abdomen, it will commonly be found that the *stomach* contains a certain quantity of water, which appears to enter into this organ by deglutition. The quantity is subject to great variation; sometimes it is large, at other times small; and in some instances, no water whatever is to be met with. This probably depends on the rapidity of death. Orfila has remarked, that the alimentary canal is occasionally much discoloured in drowned subjects. He observed, also, that when drowning took place while the process of digestion was going on, the mucous membrane of the stomach often had a pinkish-red or violet tint. When the drowned subject had remained a long time in water, the lining membrane of the stomach was observed to acquire a very deep violet or brown colour. A knowledge of this fact will be of importance in those cases where the subject removed from water is suspected to have been poisoned previously to submersion. Among the other appearances met with in the body of a recently drowned person, which require to be mentioned, is the presence of a *mucous froth*, sometimes of a sanguineous hue, covering the lining membrane of the trachea, which may be itself slightly reddened. Water is also occasionally found in the ramifications of the air-tubes, but in very variable quantity. If the body has remained a long time in water, or if, after removal, it has been exposed to the air several days previously to the inspection being made, there is commonly no appearance of mucous froth in the trachea or its ramifications. See, in reference to the post-mortem appearances in the drowned, a paper by Dr. Ogston, Med. Gaz., vol. xlvii., pp. 763, 854, et seq.: also another by Dr. Riedell, Med. Gaz., xlvi., p. 478.

Cases.—Mr. Bishop communicated to me the result of an inspection made by

Dr. Bull of Hereford and himself, in the case of a female whose body had been in the water about an hour and a half. The inspection was made twenty-four hours after death. The contracted state of the skin (cutis anserina) was well marked. The vessels of the membranes of the brain were somewhat congested, the principal seat of engorgement being at the base. The tongue was neither swollen nor indented, but pallid. Mucous froth in considerable quantity was found in the trachea:—the vesicles were exceedingly minute in the upper part, but at the lower portion of the tube they were as large as a mustard-seed. A small quantity of clear fluid flowed through the bronchial tubes when the lungs were raised. The lungs were not collapsed: they crepitated on pressure, and were rather bloodless anteriorly:—posteriorly they were somewhat gorged with blood, apparently from gravitation. The stomach had about a pint of fluid in it, which seemed to be water mixed with some undigested meat. The lining membrane was slightly pink in colour. The right side of the heart was very flabby, and contained scarcely any blood. The blood throughout the body was quite fluid. The appearances of asphyxia were not so well marked in the lungs and heart of this subject, as they usually are; nevertheless, the state of the trachea, bronchial tubes and stomach, was quite characteristic of death from drowning.

As a contrast to this, and as showing the variable nature of the appearances met with in the drowned, the following case, reported by Professor Dunglison, may be quoted.

A woman, in full health, was observed to be intoxicated on the banks of the Schuylkill, U. S., about one hour before her body was discovered in very shallow water. She could not therefore have remained long under water. The body was examined by Dr. Farquharson, one of the resident physicians, about sixteen hours after death. The face was swollen, and of a mottled purple colour. The arms and thighs presented patches of discoloration, and a small quantity of whitish froth issued from the mouth, the amount of which was not increased by pressure upon the chest, although a small quantity of watery fluid escaped when the body was turned over. On opening the chest, numerous old pleuritic adhesions were found, on the removal of which, and by the consequent compression of the lungs, a discharge of watery froth took place from the mouth. All the parts of the pulmonary tissue were gorged with blood, and were much heavier and of a darker red colour than in the normal state. The posterior portions of both lungs were more engorged underneath, or from position. The trachea and bronchial tubes contained the same kind of watery froth or frothy mucus, as that which had issued from the mouth. The liver was large, engorged, and of a bright red colour. The right cavities of the heart and the coronary veins were filled with dark fluid blood. The left cavities were empty. Such, observes the Professor, are the main phenomena occasioned by the mode of death—asphyxia from drowning. (Phil. Med. Examiner, March, 1845, 169.)

Mr. Semple, of Islington, reported in the Lancet (May 29, 1841,) two cases of drowning, in each of which he had made a careful post-mortem inspection. The subjects were both adult females. In one, the cerebral vessels were nearly empty,—the lungs rather voluminous: the bronchial tubes containing a small quantity of frothy mucus,—and the right side of the heart was filled with fluid blood (¼ lb.) There were slight marks of inflammatory redness about the membranes of the stomach and intestines,—accounted for in the stomach by digestion going on at the time of death. The organ contained about a quart of fluid matter, consisting of food mixed with water,—probably swallowed in the act of drowning: there were no traces of poison in the stomach or marks of violence on the body.

In the other case, the eyes were half open, hands not clenched, fingers straight: —cerebral vessels very much congested. The lungs were voluminous; trachea empty; bronchial tubes in their smaller ramifications filled with a soapy (?) te-

nacious mucus. The right side of the heart and larger veins were distended with fluid blood. The œsophagus contained a clear watery fluid,—the stomach, three ounces of a clear fluid destitute of smell and colour, with the exception of a green tint from a minute quantity of vegetable matter, resembling the confervæ of ponds. Liver much congested. This woman was found drowned in a shallow pond. Both subjects were examined recently after death.

Was death caused by drowning?—It is obvious that for a correct solution of this question, we shall have to consider the appearances met with in the bodies of the drowned, and to determine how far they are characteristic of this form of death. Among the *external* signs of drowning, when the body is seen soon after death, are paleness of the surface, and the presence of a mucous froth about the nostrils and lips. The absence of these appearances, however, would not prove that the individual had not been drowned; for if the body has remained some time in water, or if it has been long exposed to air before it is seen by a medical practitioner, the cutaneous surface may have undergone various changes of colour, and mucous froth may no longer be found adhering to the nostrils and lips. In speaking of the *external* appearances of the body, it was stated that foreign substances are sometimes locked within the hands or lodged under the nails of drowned subjects. This fact may occasionally afford strong circumstantial evidence of the manner in which the individual has died.

Substances grasped in the hands.—If materials be grasped within the hands of the deceased, which have evidently been torn from the banks of a canal or river, or from the bottom of the water in which the body is found, we have strong presumptive evidence that the individual died within the water. For although it is possible to imagine that the deceased may have struggled on the bank and have been killed prior to submersion, yet in the value attached to this sign, we are presuming that there are no marks of violence on the person, nor any other appearances about the body sufficiently striking to lead the examiner to suspect that death had taken place in any other way than by drowning. If the substance locked within the fingers or finger-nails be sand of the same character as that existing at the bottom of the river or pond, it is difficult to conceive any stronger evidence to establish the fact of death having taken place subsequently to submersion. The abrasion of the fingers is a circumstance of minor importance,—no value could be attached to this state of the fingers as an indication of the individual having perished by drowning, unless it were in conjunction with the appearances above described. A witness would be constrained to admit, in many cases, that the extremities of the fingers might become abraded or excoriated after death, or even before submersion, while in no case could he be called upon to make, in regard to substances found grasped within the hands, an admission which would invalidate the evidence deducible from this condition. This must be regarded as a most satisfactory proof of the individual having been alive after his body was in the water. It is well known that when two or three persons are drowned by the same accident, they are not unfrequently found clasped within each other's arms,—a fact which at once proves that they must have been living when submerged. So if a dead body be discovered still holding to a rope, cable or oar, no further evidence is required to show that the deceased must have died by drowning. The signs upon which medical jurists chiefly rely as proofs of death from drowning are,—1, water in the stomach; and 2, water with a mucous froth in the trachea and lungs.

Water in the stomach.—It has been remarked that water commonly passes into the stomach of a living animal while drowning, and this most probably takes place by the act of deglutition; for it has been observed that when an animal is stunned prior to submersion, water does not pass into the œsophagus. As a proof that its entrance into that organ depends on deglutition, it may be stated that the quantity contained within the stomach is greater when the animal is allowed to come frequently to the surface and respire, than when it is maintained

altogether below the surface. The power of swallowing is immediately suspended on the occurrence of asphyxia, and in this way may we perhaps most satisfactorily account for the difference observed in the two cases. The water thus found is in variable quantity; and there are some cases of drowning in which water is *not* discovered in the stomach. It was found by Dr. Ogston, of Dundee, in five cases out of seven. (Ed. Med. and Sur. Jour. Jan. 1837.) In dissecting cats which had been drowned, I have repeatedly remarked the absence of water from the stomach: in these instances, the animals had been invariably kept under water from the first moment of their submersion, and thus in a condition but little favourable to the exercise of deglutition. Water does not readily penetrate into the stomach of a subject which has been thrown in after death; the sides of the œsophagus applying themselves too closely to each other, to allow of the passage of the fluid. If putrefaction has advanced to any extent, it is possible that water may enter; but the practitioner will easily judge from the general state of the body how far this process may have been concerned in the admission of fluid into the stomach and alimentary canal. Orfila has suggested that water may be found in the stomach of a subject apparently drowned, in consequence of this liquid having been drunk by the individual or artificially injected by another into the stomach after death. It is difficult to conceive under what circumstances such an injection could be made, or what purpose it would answer. The quantity would determine whether it was likely to have been drunk by the person before immersion. It is of course presumed, that the liquid contained within this organ is of the same nature as that in which the body is immersed; for it is possible that fresh water may be found in the stomach of a person drowned in salt water, and in such a case it would be obviously improper for a medical witness to affirm, from the mere existence of water in this organ, that the individual had died within the medium in which his body was discovered. If the water contain mud, straw, duckweed, moss, or any substance existing in the pond or river where the drowning occurred, this is a proof, when the inspection is recent, of its having been swallowed by a living person. In the well known case of *Mary Ashford* (*Rex.* v. *Thornton*, Warwick Summer Ass. 1817) duckweed with about half a pint of water was found in the stomach of the deceased. The body was discovered in a pond in which duckweed was growing. This fact, notwithstanding the presence of other marks of violence, proved that the deceased must have been living when immersed. The following case occurred at Maidstone, in July, 1843. The body of a young woman was found in the Medway, under circumstances that led to a suspicion of murder. The medical witness deposed that there were no marks of external violence, nor any sign of the deceased having struggled with the supposed murderers. There was some long grass at the back of the mouth, and in the fauces. The grass was not the same as that growing on the banks of the river, but such as grew at the bottom, and which the deceased had probably swallowed after having gone living into the water. On this evidence the accused was discharged. In an interesting case investigated by Mr. Image (*Reg.* v. *Carnt*,) Bury St. Edmunds Lent Assizes, 1851,) the body of deceased was found with her head among water-weeds, some of which were discovered in her throat, and the finger-nails were filled with sand and mud, as if clutched convulsively. These facts aided in proving that deceased had died by drowning. The absence of water from the stomach cannot, however, lead to the inference that the person has not died by drowning, because in some instances it is not swallowed, and in others it may drain away and be lost after death.

Mucous froth in the trachea and lungs.—The interior of the trachea in a drowned subject is frequently covered by a mucous froth, and this is stated in some instances to have been so abundant as to have filled the air-tubes and their ramifications. It is sometimes disposed in a layer of minute vesicles tinged with blood. The origin of this appearance has been variously accounted for; but it

is probable that it is produced by the simple agitation or admixture of the air respired during the act of drowning with the mucous secretion of the air-passages which perhaps under these circumstances is more copiously poured out. This mucous froth is not always met with in drowned subjects: 1. It has not been found in the bodies of those who have sunk at once below the surface. 2. The appearance may not be seen when the subject has remained for a long period in the water after death, since by the free passage of this fluid into and out of the trachea, the mucous froth, although formed in the first instance, will disappear. 3. If, after removal from the water, the subject be exposed to the air for several days before it is examined, it is rare that this appearance is seen. 4. The mucous froth may have been formed in the trachea, but it may have entirely disappeared, owing to the incautious manner in which the body has been handled in its removal from the water. Thus, if the subject be removed from water with the head depending, any fluid which may be contained within the lungs will escape; and in passing through the trachea, this fluid will effectually obliterate the frothy appearance. A similar appearance has been found in the bodies of those who have been hanged, or who have died from apoplexy. The introduction of any liquid into the trachea during deglutition may produce it. A case is reported where, in poisoning by laudanum, water containing sulphuric ether was forced down the throat of a person after the power of swallowing had ceased. On dissection a quantity of reddish froth was found filling up part of the trachea. Dr. Riedell looks upon the presence of this froth in the air-tubes as a constant sign of death by submersion, when the body is recently inspected: Med. Gaz. xlvi. p. 478.

Water in the lungs.—Many contradictory statements have appeared relative to the presence of water in the lungs of the drowned. It is an appearance only occasionally met with; for the glottis does not in every case of drowning become so effectually closed as to prevent the introduction of a portion of liquid into the pulmonary cells. In certain cases no water is found in the air-tubes after death, and when present, the quantity depends on many contingencies. It is commonly small, often about an ounce, but it is subject to variation, and is probably affected by the number of forced attempts at respiration made by the drowning animal. In experiments on animals, I have not remarked any difference in the quantity whether the animal was allowed to rise to the surface and respire, or whether it was maintained altogether below. There is but little doubt that the quantity may become increased after death, because it is now well known that water will penetrate into the lungs, before the access of putrefaction, when a body has been thrown in dead. It is important for a medical jurist to bear this in mind, as it may influence materially the opinion which he may be disposed to form on the discovery of water in the lungs of an apparently drowned subject. Water may therefore be present in the lungs, and yet it will afford no evidence of drowning. When the water in the lungs is mixed with *weeds* or *mud*, and water presenting the same admixture is found in the throat and stomach, this is strong evidence that the body has been plunged into water, when the power of breathing and swallowing still existed, and therefore that the deceased has been drowned. An attention to the condition of the stomach and lungs will therefore be of importance in cases of alleged child-murder by drowning, since it may aid in proving or disproving the charge. In a case tried at the Central Criminal Court, April 1851, in which I was consulted by Mr. Tyte of Harrow, some greenish-coloured mud was found in the throat, lungs, and stomach of an infant whose body had been removed from a pond. The prisoner was acquitted, because it was suggested that she might have thrown the body of her child into the water when she believed it to be dead, and one or two gasps might have accounted for the appearances presented by the stomach and lungs! It has been suggested that water may have been injected into the lungs after death, in which case an incorrect opinion might be formed from its presence, if the body were discovered

on the bank of a river or canal. This, however, is an obstacle but little likely to interfere with any medical investigation. On the other hand, the absence of water from the lungs of a subject found apparently drowned, must not be considered to indicate that death was not a consequence of drowning; for if the body of a drowned person be allowed to remain with the head depending, the water originally contained within the lungs will drain out; or if it be long exposed before undergoing an examination, the probability is, that none will be discovered in these organs, since in the progress of time it may disappear by imbibition and evaporation. According to Dr. Riedell, the lungs are very flabby, and are greatly increased in weight.

Want of evidence on inspection.—It may be fairly considered that after the lapse of *five or six weeks*, especially if the body have been removed from the water for the greater part of that period, none of the usual appearances of drowning will be met with: in the present day, no practitioner would think of seeking for evidence under such circumstances. The medical opinions expressed by the witnesses for the prosecution at the trial of *Spencer Cowper*, for the murder of *Sarah Stout* (Hertford Assizes, 1699,) are therefore worthy of remark, if only as affording an example of what is to be avoided on these occasions.

The body of the deceased was found floating in a stream probably not more than thirteen hours after she was missed. It was buried, and *six weeks* afterwards was exhumed and examined. No water was found in the stomach or lungs, which were not putrefied. Six medical men deposed, that when a person was drowned, water was invariably taken into the stomach and lungs; and as none was found in this instance, they were of opinion that deceased came to her death by some other means;—in other words, that, as alleged in the indictment, she had been murdered by the prisoner, and her dead body afterwards thrown into the water! The prisoner asked one of these witnesses whether, after six weeks time, water would remain in the body? The reply was, that there should be some, because "it can't come out after the body is dead, *but by putrefaction;* and there was no putrefaction." The witness does not appear to have had the least suspicion that the deceased might have died without swallowing any water, or that the quantity swallowed might have been small, and entirely lost in six weeks by transudation through the soft parietes of the stomach! The prisoner was acquitted.

Specific gravity of the body.—At the trial of *Spencer Cowper*, above alluded to, the buoyancy of the human body, living and dead, formed an important part of the inquiry. The body of the deceased was found floating at about five or six inches below the surface of the water, which was only five feet in depth. From this circumstance it was assumed that she could not have gone living into the water, because, as it was alleged, and attempted to be proved by scientific and *nautical* testimony for the prosecution, the body of every person who died in water sank, while a dead body thrown into water floated! A sailor was called to support this strange piece of nautical philosophy; and although his statements were contradictory, he swore that in all the battles and shipwrecks in which he had been engaged, he had uniformly observed that those who were drowned floated; while those whose bodies were thrown in dead sank! Hence, he contended, it was necessary to attach weights to the bodies of those who died at sea. "Why," said this witness, "should Government be at that vast charge to allow threescore or fourscore weight of iron to sink every man, but only that their swimming about should not be a discouragement to others?" (Smith's Anal. of Med. Ev. 278.) The medical witnesses for the prosecution contented themselves with stating that the bodies of persons who were drowned sank, without taking into consideration that there were circumstances here which might have accounted for the floating, and have entirely set aside the hypothesis of death before immersion. This female was drowned in her clothes: there were some stakes near the body, which might have aided in supporting it; and the presence of air or

gases in the intestines would have sufficed to explain a simple fact, by which the Court and scientific witnesses appear to have been completely bewildered. Other sailors were called for the defence, who deposed, that after having shipwrecks, they had always observed the bodies of the dead to sink, and that weights were attached to bodies buried at sea, not for the purpose of sinking them, but of preventing them floating afterwards by putrefaction.

Although it is not likely that the life of any one will ever again be endangered by a question of this kind, it is proper to state a few facts connected with the specific gravity of the human body.

The specific gravity of the human body, in the *living* healthy state, is made up of the combined specific gravities of its different parts;—so that, as in all heterogeneous solids, it is a very complex quantity. The only part of the body which is lighter than water is fat. The specific gravity of this is 0·92; the specific gravity of muscle is 1·085; and of bone,—the heaviest part of the body,—2·01. The lightness of the fatty portions is far more than counterbalanced by the weight of the skeleton, so that the naked human body, placed on water, has always a tendency to sink. This tendency diminishes just in proportion to the quantity of the body immersed;—because all those parts which are out of water, not being supported by water, become so much additional absolute weight to the portion immersed. Hence the frequent cause of death by drowning. An inexperienced person exhausts himself by exertion, raises his arms continually out of the water, and as often sinks, owing to their weight having just so much effect upon his body as if a leaden weight had been suddenly applied to his feet to sink him. When the *whole* of the living body is immersed, the specific gravity, owing to the expansion of the chest, differs so little from that of water, that very slight exertion will suffice to keep an individual on the surface.

From what has been observed relative to the component parts of the body, there are two circumstances which must cause its specific gravity to vary. If the quantity of fat be abundant, it will be diminished; and such an individual will float more readily than another in an opposite condition. On the other hand, the abundance of *bone* will render a person heavier than his bulk of water: and his body will sink more rapidly than that of another. Now these two modifying causes of buoyancy are liable to constant variation; hence, the different accounts given by experimentalists relative to the specific gravity of the human subject. The bodies of females are, *cæteris paribus*, of less specific gravity than those of males: the skeleton is smaller, and there is a greater abundance of fat. Very young children float with the greatest ease: the quantity of fat is usually in large proportion, and the bones are light,—the earthy matter being not yet freely deposited. Thus, in infanticide by drowning, the body of the child rises very speedily to the surface,—if, indeed, it does not remain altogether upon it.

There are some other points to be considered in relation to the buoyancy of the living human subject. 1. *Respiration.*—It is the fact of the lungs being filled with air that gives the general lightness to it. If these organs were emptied, and the chest contracted, then the specific gravity would be considerably increased: hence it follows, that, *cæteris paribus*, an individual with a large and capacious thorax floats more readily than one whose chest is small and contracted. Hence, also, the body has a tendency to rise out of water during inspiration, and to sink during expiration:—the quantity of water displaced under these two opposite conditions of the respiratory organs being very different.

The fact of *clothes* being on the person will make a difference; either, from their nature, serving to buoy him up, or to sink him more deeply. Females are sometimes saved from drowning by reason of their clothes presenting a large surface; and it is owing to this that the bodies of drowned females often remain floating on the water immediately after death. This happened in the case of *Sarah Stout* (ante, page 475.) In a case of suicide at Plymouth, (January, 1849,) it was proved at the inquest that the body of the deceased floated in the

sea-water for half an hour after the act of drowning. It was probably buoyed up by the clothes.

So far with the living subject. It may be laid down as a general rule, that the recently *dead* body is, when left to itself, always *heavier* than water, and sinks when immersed. The emptiness of the chest, combined with the fact that the bones and all the soft parts, excepting the fat, are heavier than water, offers a sufficient explanation of the sinking. After a variable period, generally not more than a few days, the body will rise again to the surface, and float. The period of its rising will depend—1st, on the specific gravity of the body; 2d, on the nature of the water; 3d, on the access of heat and air, in facilitating putrefaction. If the gases generated find an escape, the body will sink:—more gases may form, and then it will again rise, so that the sinking and rising may become alternate phenomena.

A very small quantity of air, derived from putrefaction, will suffice for the floating of the body. Thus, taking the specific gravity of the dead body even at 1.08, it would require but little air to keep it at or near the surface of the water. The bodies of the drowned, when they float from putrefaction, generally rise to the surface about the fourth or fifth day after submersion in shallow water, unless held down by mechanical obstacles. But a dead body may be prevented from sinking at all, partly, as it has been observed, in consequence of the clothes, and partly in consequence of its having been caught and supported by stakes, or other obstacles in the water,—or from the presence of a quantity of air in the intestines.

Survivorship of the drowned. Decomposition in water.—Some medical jurists have proposed the question, whether, when several persons fall into water at the same moment, and are drowned, we can determine which among them was drowned first, or which survived the others. M. Devergie attempts to bring forward an answer to this question, from the state of the heart, lungs, and brain (*op. cit.* 321;) but it is needless to say, that the condition of these organs can furnish no certain evidence. Even if a medical practitioner chose to adopt such hypothetical views, it is certain that they would not be received as evidence by an English Court of Law. When two bodies are found in the same spot in a river, it is allowable to form a limited presumption (from the different degrees of putrefaction in the two) as to which has been submerged for the longer period.

The body of a drowned person after lying for some time in water undergoes the usual putrefactive changes indicated by discoloration of the skin and muscles, with softening of the animal substance (ante, page 469;) but in some cases, where the circumstances are favourable, a change of a peculiar kind takes place. This consists in the slow conversion of the fatty parts of the body into a species of soap called *adipocire*. The experiments of Chevreul have proved that this compound is nothing more than an animal soap with a base of ammonia or lime, the former alkali being the result of the decomposition of the nitrogenized principles of the body, while the fat becomes acidified. A medico-legal question has more than once arisen respecting the length of time which a body should remain in water, in order that this adipocerous transformation of the tissues may be observed. Dr. Gibbs, of Bath, found that by macerating muscle in water for about a month, he was able to procure only a small quantity of adipocire. Dr. Harlan, of Philadelphia, observed that the integuments of a cranium were, by maceration, converted into adipocire in about six weeks. In some experiments which I have made on the subject, the conversion of muscle and fat to adipocire was not complete in stagnant water under a period of two months. Thus, then, we may say, that a *month* is about the *earliest period* at which the change is likely to be observed. The experiments of Orfila and Devergie prove, that with bodies interred in the soil the change is much longer in taking place. The following singular case, which was tried at the Warwick Lent Assizes, in 1805, will show the medico-legal relations of this subject. A gentleman, who was in-

solvent, left his home on the 3d November; and on the 12th December following his body was found floating in the river much decomposed, and the dress rotten. There was no doubt that he had committed suicide. A few days after he was missed, a commission of bankruptcy had been issued against him; and the question was, whether he was or was not living at the time it was issued. If not living, then the commission was void. As nothing positive was known on the subject, the only evidence on the point was derived from an examination of the body. The muscles of the lower part of the abdomen and the glutei were found to have become converted into adipocire; and from this fact, it was inferred to be in the highest degree probable that his body had been in the water during the whole period of his absence—thirty-nine days; in short, that he had drowned himself on the day he left the house. Several medical witnesses were summoned on both sides. Dr. Gibbs and two others gave a strong opinion that from the slow formation of adipocire in the drowned, it was reasonable to infer that the body of the deceased had been in the water for the whole period of five weeks and four days. The jury returned a verdict in accordance with this view, namely, that the deceased was not living at the time the commission was issued against him. The late Mr. Callaway informed me that he was required to give evidence in a similar case in the year 1836.

Summary of medical evidence.—We have now reviewed the whole of the evidence which the post-mortem examination of a drowned subject is capable of affording to a medical witness. It will be seen that the only characters met with *internally*, upon which any confidence can be placed to indicate that the individual has been drowned, are the presence of water in the stomach, and the presence of a mucous froth on the lining membrane of the trachea; but at the same time, the restrictions to the admission of these signs, as positive evidence of drowning, may be such as to throw great uncertainty on the correctness of a medico-legal opinion founded simply on their existence. The practitioner must then determine, before he decides positively in a question of this nature, whether there be any appearance about the person which would lead to the suspicion that death has been caused in another way. When he has provided himself with this negative evidence, and he finds that the characters of drowning, already enumerated, are present,—or, if absent, he can, with any show of probability, account for their absence, he is then justified in giving a decided opinion on the subject.

A man died suddenly in the Rue St.-Antoine, at Paris, in February, 1830, and was soon after brought to the Morgue. The body underwent a minute examination; but there was no mark of violence externally, nor was there any morbid change to account for death internally. In the course of the dissection, it was found that the larynx, trachea, and air-tubes contained a frothy mucus. In the larynx this was white, but it had a red colour in the air tubes. M. Devergie, who conducted the inspection, states, that it only differed from the froth, as it exists in the trachea of the drowned, in the circumstance of its being in larger vesicles;—but he candidly owns, that had he not been certain of the contrary, he should have presumed that he was examining the body of a person who had died by drowning. Besides this appearance, there was a large quantity of water in the stomach, amounting to almost a pint; and the lungs were gorged with blood, as in cases of asphyxia.

Supposing that this body had been thrown into the river after death, it is clear that most medical men, relying upon what are usually regarded as well marked proofs of this kind of death, would have declared this to have been a case of drowning. A practitioner could not be censured for forming such an opinion, since it would be founded upon the best ascertained rules of past experience; and there are no others by which a medical jurist can be guided. In the mean time, we learn, by the occurrence of such a case, how cautious we ought to be in expressing a positive opinion in a question of this nature, even where medical circumstances exist to support it.

If, however, a case of this kind be of rare occurrence, we will take an instance of an opposite description. An individual may be suffocated, or may die from apoplexy, or from the sudden attack of any fatal disease which may not be indicated by any well marked post-mortem appearances: the body is thrown into water, and remains there a few days. When taken out, water may be found in the lungs, but there may be none in the stomach; and there may be no mucous froth in the trachea;—yet how is a practitioner to determine whether death has actually taken place within the water or not? In the case of a suffocated body, without traces of external violence, it would be impossible; since we have seen that individuals may die in the water, or at the moment of immersion, and, therefore, under circumstances in which the appearances of drowning would be entirely wanting.

If, in examining a body taken from water, we discover traces of mortal disease, or marks of external violence sufficient to destroy life, then there is always room for suspicion. Why the body of a person, who has really died from *natural causes*, should be afterwards thrown into water, it would not be easy to explain; but we can readily appreciate the motive where murderous violence has been used.

In consequence of the uncertainty attendant on the appearances of drowning, barristers have considerable advantage in cross-examining those medical witnesses who appear for the prosecution. Legal ingenuity is here often carried to the utmost, to show that there is no positive or well defined *sign* of drowning; and, therefore, the inference is drawn that the deceased must have died from some other cause. A trial took place at the Central Criminal Court, April, 1841, in which the witnesses were very severely examined on the appearances caused by drowning. (The *Queen* v. *Longley*.) The general impression among non-medical persons appears to be, that whether in drowning or suffocation, there ought to be some particular *visible change* to indicate at once the kind of death; but it need hardly be said that this notion is founded on very false views; and if the reception of medical evidence as to the cause of death be made to depend on the production of some such positive and visible change, then it would be better at once not to place the parties charged with the offence upon their trial, because the crime could never be proved against them. A medical inference of drowning is founded upon a certain series of facts, to each of which individually it might be easy to oppose plausible objections; but, taken together, they often furnish evidence as strong as is commonly required for proof of any other kind of death. In the case above referred to, the prisoner was cleverly defended. The deceased, a child, was drowned by the mother. When the body was removed from water, the mouth was closed: the prisoner's counsel wanted to make it appear that it was most usual to find the mouth *open* in cases of drowning; and then went on to say, "that the only proof of suffocation by drowning which had been adduced by the medical witness was the frothy mucus found in the air-cells;—that it could not have gone through the mouth was quite certain, because the mouth was proved to have been closed. The air might have passed into the air-cells of the child, whilst struggling in its mother's arms, just as well as whilst struggling in water!" After what has been stated, it is not necessary to point out the fallacy of the assumptions involved in this argument; but it is much to be regretted, that medical evidence should be allowed to be presented to a jury in such a perverted form. The wonder is, that even in a case of undoubted criminality (as in that particular instance) a conviction should ever occur. (See also the case of The *Queen* v. *Owen, Thomas, and Ellis*, Stafford Lent Assizes, 1840.) In a case in which Mr. Image, of Bury St. Edmunds, gave evidence (*Reg.* v. *Carnt*, Suffolk Lent Assizes, 1851,) the medical facts, although furnishing conclusive evidence of drowning when taken together, were individually objected to. The deceased was found dead in a pond. The body was removed after it had been lying about four hours in the water, and was carefully examined by Mr. Image

forty-one hours after death. The hair was hanging back, wet, very muddy, with leaves and weed entangled, the ears were muddy, the right eye ecchymosed, pupils slightly dilated, lips bluish, and there were bluish patches on the face. Slight scratches were observable on the right side of the face. The jaws were fixed, teeth tightly clenched, and the tongue not protruding. The nails were filled with sand and mud. There were severe bruises on both arms near the elbow, equal in extent and intensity. The tongue was greatly congested, and covered with froth and mud, which extended backwards to the throat and nostrils, as well as into the larynx and trachea or windpipe, and the upper divisions of the air tubes of the lungs. The lungs were engorged and greatly distended: when cut in any part, frothy mucus was abundantly poured out, and much fluid escaped on pressure. There were small pieces of green weed in the air-tubes (corresponding to weed in the pond.) The vessels of the neck were distended with dark-coloured liquid blood, without any coagulum. The stomach was healthy; it contained partially digested food, with about a pint of liquid mixed with mud and sand. The liver was enormously congested, bleeding profusely at every section. The bladder was quite empty, and contracted to the smallest size. The sinuses of the brain were not much distended, nor was the substance of the organ greatly congested. Mr. Image gave an opinion, which was perfectly justified by these appearances, that the deceased had died by drowning, and that she had probably been held forcibly under water. The accuracy of this opinion was established by the confession of the criminal before execution.

Marks of violence on the drowned.—The chief inquiry with regard to marks of violence on the bodies of the drowned is, whether they have resulted from accident or design, and in forming an opinion a witness must give due value to the accidents to which a body, floating loosely in water, may be exposed. Ecchymoses of considerable size are sometimes seen on drowned subjects, where they have been carried by a current against mechanical obstacles in a river or canal. If the deceased fell from a considerable height into water, his body, in falling, may have struck against a rock or projection, and have produced a very extensive mark of violence. Dead bodies taken out of wells, the deceased persons having fallen in accidentally, or having thrown themselves in intentionally, often present considerable marks of violence of a vital character. The presence of these must not create a hasty suspicion of murder. It is manifestly impossible to lay down any specific rules for forming a decision in cases of this kind, since probably no two instances will be met with which will be perfectly similar. In clearing up these doubtful points, every thing must depend on the tact and acumen of the practitioner who is called upon to conduct the investigation. The first point which he has to determine is, whether the injuries on the body were produced before or after death. (See ante, WOUNDS.) If after death, then they ought to be obviously of accidental origin. Accidental violence may sometimes be of a very serious nature,—so serious that a practitioner might well doubt whether it did not indicate that the deceased had been violently injured prior to submersion. If a dead body were taken out of water, with one or both extremities dislocated, or the cervical vertebræ fractured, and a surgeon were asked whether such injuries could be accidental, and coincident with, or consequent on drowning, the answer would probably be in the negative: but an instance has occurred where both arms have become accidentally dislocated at the shoulders in the act of drowning. I allude to the case of a man, who some years since, jumped from the parapet of London Bridge into the Thames. This exploit, it appears, the man had previously performed with impunity, but in this instance he sank and was drowned. Both his arms were found dislocated, in consequence, it is presumed, of his having fallen with them in the horizontal position, instead of placing them closely to his sides. The concussion on falling into the water, had sufficed to produce the accident. (Smith's For. Med. p. 228.) Here, then, we have a proof that even the mechanical resistance offered by water alone, may give rise

to marks of very violent injury on the person. Extravasation of blood may take place into the cavities from this cause. Dr. N. Chevers informs me that he assisted in examining the body of a sailor who fell into the water, vertex downwards; and it was found that there was an extravasation of blood in the head, beneath the arachnoid membrane.

It has been observed, with respect to superficial marks of violence, that *bruises or contusions* are not always visible on the bodies of the drowned, when they are first removed from water. This may be owing to the skin having abundantly imbibed water,—the colour of the ecchymosis being thereby concealed. After a short exposure to air, the water evaporates, and the bruise or contusion becomes visible. The great point with regard to all marks of violence on the drowned, is to throw light upon the questions: 1, whether drowning was really the cause of death; and 2, whether, if so, the act was the result of accident, suicide, or homicide. This last question does not concern a medical witness so much as the jury, who will determine it from the facts proved before them.

There is one case of rare occurrence, in which a practitioner would be apt to be misled by trusting to the appearances found on the drowned. If a dead body were removed from water with a deep ecchymosed circle round the neck, evidently produced by a cord or ligature, but no traces of which could be found, it is not improbable that a suspicion would be at once raised, that the deceased had been murdered by strangulation, and the body afterwards thrown into water. An accident occurred a few years since, in which a gentleman and his wife were thrown into the water by the overturning of a small boat. The lady was drowned. On an examination of the body, subsequently made, a livid circle was found round her neck, as if she had been strangled. She had evidently died by drowning, but the mark had been produced by the string of a cloak which she wore at the time of the accident. In her struggles to reach the boat, it is presumed that the tide had drifted the cloak in the opposite direction, and thus produced the appearance of strangulation. It is not improbable that this accelerated death. Barzellotti mentions the case of a man who was drowned in the Po, while being escorted along the banks of the river, as a prisoner, by a party of soldiers. The man attempted to escape, and was drowned. Besides the ordinary marks of drowning, there was a deep livid circle, extending completely round the neck, and immediately below this, another mark, but paler in colour. The skin over the trachea was ecchymosed. It was supposed that the deceased had been strangled by the soldiers, and his body thrown into the water, but from the appearance of the marks, and other circumstances, Barzellotti gave it as his opinion, that they were produced by the collar of a coarse linen shirt which had been tightly buttoned around the man's neck,—the collar had retracted from the imbibition of water, and had thus caused the appearance of strangulation, like any other ligature. (Questioni di Medicini Legale, i. 329. For another case, see Henke's Zeitschrift, 1840, i. 126, Erg. H.) The following case was mentioned to me as having occurred during the heavy floods in the winter of 1839. A man was carried away and drowned in attempting to ford a swollen stream. When the body was found, it had been so placed by the current, that the fore-part of the neck was locked against the stump of a tree, giving rise to an ecchymosed patch like that which is commonly produced by manual strangulation. For an interesting case, in which there was much violence to the neck, see Henke's Zeitschrift, 1842, i. 258, Erg. H.

It might be said that in cases of this description circumstantial evidence would commonly show how the mark had originated. In admitting the truth of this observation, we must remember that circumstances, as matters of proof, do not always present themselves to our notice, or occur to our judgment, at the precise time that the course of justice stands most in need of them. While, then, we use great caution in drawing an inference where there are such strong grounds for suspicion, we should not neglect to examine carefully the most trivial ap-

pearances. In one remarkable case of murder, where the body of the deceased was discovered in a mill-stream, there was only one slight ecchymosed depression in the fore-part of the neck, as if from a finger. The surgeon suspected from this that the deceased had been strangled. The marks of drowning in the lungs were wanting; and the suspicion of the real cause of death was afterwards confirmed by the detection of the criminal.

Accidental fractures in the drowned.—*Fractures* are not often met with in the drowned as the result of accident during or after the act of submersion. Certain fractures likely to be followed by immediate death may forbid the supposition of their having occurred after the act of submersion, and a careful examination of the body may show that they were not likely to have arisen from accident at or about the time of submersion. This point was raised in the case of *Reg. v. Saltleband* (Nottingham Winter Ass. 1843,) where the prisoner was charged with the murder of his son, a boy aged ten years. The deceased was found dead in a pond soon after he had been seen healthy and well. An inquest was held, and as usual no inspection of the body was required by the coroner, and the jury were directed to return a verdict of "found drowned." An inspection was, however, subsequently made. The neck was observed to be very loose, and on further examination the processus dentatus was found to be separated from the atlas and the ligaments were ruptured! The three medical witnesses who gave evidence at the trial, deposed that this displacement had caused death by compressing the spinal marrow,—that the injury had occurred during life,—that it was not likely to have been caused by accident from a fall into the water, as there was no mark of a bruise about the head, and the pond was proved to be small, with a soft muddy bottom. All agreed that such an injury was not likely to have arisen from a blow or a fall under any circumstances, because it required for its production that the body should be fixed, and the head forcibly rotated on the trunk. It was in itself sufficient to account for immediate death, and it could not occur by accident after death from any other cause. Hence it was inferred —1, that death could not have been caused by drowning; 2, that it had resulted from the compression of the spinal marrow, by displacement of the second vertebra; and, 3dly, that this injury must have been intentionally produced by some person. Circumstances fixed the crime on the prisoner, and the jury returned a verdict of manslaughter; although the nature of the injury, admitting that it was not the result of accident, proved that the prisoner must have acted with a most cool and deliberate intention to destroy life! This case furnishes a serious commentary on the practice of certain coroners, in denying the necessity for an inspection, and in directing what is called an open verdict of "*found drowned*" when a body is taken out of water!

It is an important medico-legal question, whether fractures of the *cervical vertebræ* can occur from accident alone, about the time of drowning. In the above case, the medical witnesses had probably good reasons for denying that the injury was accidental, although such an opinion cannot always be expressed merely from the absence of marks of violence on the head. Mr. South gives the case of a man who threw himself into a river to bathe from a height of seven or eight feet, the water being only three feet deep. He rose to the surface, but fell back senseless. When he recovered his consciousness, the account he gave of the accident was, that he felt his hands touch the bottom of the river, but a wave save his head drew it violently back, upon which he lost all consciousness. He died in about ten hours, and on examination the back of the neck was much ecchymosed—the interspaces of the muscles were gorged, and the vertebral canal filled with blood. The body of the fifth cervical vertebra was broken across about the middle of its depth, and the two pieces were completely separated from the lateral parts. As there was no mark of contusion or dirt on the head, Deveillon, who reports the case, believes that the fracture arose from muscular action, and not from a blow received by striking the bottom; but this is doubtful

In another instance related by Mr. South, a sailor jumped headlong into the sea to bathe, a sail being spread three feet below the surface. He immediately became motionless, and died in forty-eight hours. The fourth and fifth cervical vertebræ were found extensively fractured, and the spinal marrow was crushed and lacerated. (Chelius's Surgery, Part vi., Fractures.) In this case the fracture must have resulted from contact with the water or the sail; but as the latter was freely floating, this would be a yielding medium; hence this serious injury may occur accidentally in cases in which we might not be prepared to look for it. (For an important medico-legal case, involving many questions connected with marks of violence on the drowned, see Ann. d'Hyg. 1839, ii. 195.)

Was the drowning the result of homicide, suicide, or accident?—Although the question, whether the act of drowning was the result of suicide or murder, properly falls within the province of a jury, there are certain points in relation to it which here require to be noticed by a medical witness. In the first place, it is not to be imagined that a post-mortem examination of the body will develope any differences in either of the three supposed kinds of death. So far as the phenomena of drowning are concerned, they are the same; and are accompanied by the same post-mortem appearances in each case. In drowning which is accidental or suicidal, it is not common, as it has already been observed, to meet with marks of violence on the person, except such as are purely of *accidental origin*, and have commonly been produced *after death*. In accidental drowning, this is almost a constant rule; but if the individual has fallen from any height, his person may be injured in the fall either by projecting bodies on the banks of a river or canal, or by mere concussion on the water, allowance for either of which we must be prepared to make, according to the situation of the spot from which the party is supposed to have fallen.

It is calculated that drowning is the cause of death in nearly *one-half* of all suicides; but this of course will vary according to localities. In *suicidal* drowning we have a difficulty to encounter which we do not meet with in that which is *accidental*. A man may have attempted suicide by some other means, previously to precipitating himself in the water: thus, then, besides the accidental violence of accidental drowning, we may meet with violence on the person evidently indicating wilful perpetration. What is the nature of this violence? Is it to be defined? Can it always be distinguished from that which is positively *homicidal?* The answers to these questions must depend on the circumstances proved in each case.

A man may attempt to hang or to strangle himself, and not succeeding, may afterwards drown himself. Here we should find a mark on the neck, which many would at once deem presumptive of murder. If the suicide had neglected to remove the cord from his neck, death would be considered still more clearly to have arisen from murder. A suicide may produce a severe penetrating wound on his person, and afterwards drown himself. In such a case, it is not even the necessarily mortal nature of the injury which would allow us to come to a prompt decision; for although a man labouring, for instance, under a penetrating wound of the heart, or a deeply incised wound of the neck, is not likely to run far, or to require to drown himself in order to die, yet instances are on record where such wounds have been inflicted on the brink of the water and even at the moment of precipitation, to ensure a speedy death. The same remark also applies where a gun-shot wound of great extent exists on the body, as when the abdomen, chest, or head has been traversed by a pistol-bullet; for suicides have been known to shoot themselves immediately before throwing themselves into water. But of all cases, perhaps, that of the evidence of poisoning, by the discovery of poison in the body of the drowned person, is calculated to produce the greatest ambiguity; since it is obvious that the deceased may have taken poison, and, before its fatal operation on the system, have had time to complete the act of suicide by drowning. A case of this kind has been communicated to me by Dr. Barker, of Bedford. A

young lady committed suicide by drowning, and on examining the stomach a senic was found therein, which she had swallowed previously to throwing herself into the water. These difficulties, it is true, are commonly removed by circumstantial evidence; but this is wholly collateral to the duties of a medical witness. He must treat the case as one which is purely medical; for when the Court puts a question to him relative to the possibility of any of the above coincidences existing, he is obliged to give an abstract answer either in the affirmative or negative. If his opinion were founded wholly on circumstantial evidence, and not on medical principles, it would be rejected, since it is for the jury alone to connect the circumstantial with the medical evidence.

Are there no rules, then, it may be asked, to distinguish suicidal from homicidal drowning? Medically speaking, the drowning is presumptively suicidal when there are no marks of violence; and it is presumptively homicidal when severe vital injuries, of a more or less speedily mortal or dangerous character, and not likely to have had an accidental origin, are met with. The latter presumption is founded on the fact, that murder by drowning is extremely rare without previous violence being used by the murderer. The homicide generally leads to his own detection by inflicting more violence than is necessary for the destruction of his victim.

In all these cases, when the facts are unknown, there is a rule which, it appears to me, the examiner ought to follow; and that is, never to pronounce a positive opinion in favour of homicidal drowning from violence on the person of the deceased, unless the violence be so situated on the body that it could not have been self-inflicted, and unless it be of a nature to have destroyed life speedily.

Drowning in shallow water.—Homicide has been sometimes presumed from the peculiar circumstances under which the body has been discovered. Thus, for instance, it has been a debated question, whether a person intent on suicide can actually drown himself in *shallow* water. This question has been long since settled in the affirmative by the occurrence of some well authenticated cases: it appears to have been raised originally on the theoretical view, that the resolution of a suicide would fail him in such a situation, and that having the means of escape, he would lose no time in extricating himself. It need hardly be remarked that the mere immersion of the mouth in water not more than a few inches deep will produce all the phenomena of death by drowning, with the exception that little or no water would probably be found in the stomach. Devergie mentions an instance which occurred in May, 1833, where a man was found drowned in a small stream, his face towards the ground, and his head just covered by the water, which was not more than a *foot* in depth. On dissection, there were all the appearances of drowning present, and a large quantity of sand and gravel was found occupying the trachea and bronchial ramifications. (Op. cit. ii. 332.) A case is mentioned by Dr. Smith, in which a woman committed suicide by breaking a hole in the ice of a pond, during the winter, and thrusting her head into the water, the rest of her body being out. In May, 1837, a man was found dead near Mitcham in Surrey. He was discovered lying on his face in a small stream of water only six inches deep. The water was so shallow that it did not cover the deceased's body or his head. There was clear evidence that this was a case of suicidal drowning.

The discovery of bodies under these circumstances does not necessarily establish that the act was suicidal. It is quite possible that one or more murderers may hold a person's head in such a position sufficiently long to destroy life; but as the party might be capable of making resistance, we ought then to find marks of violence on the body. So, again, such a position is by no means incompatible with accidental drowning; and on this it may happen that a medical practitioner will be called to express an opinion. A man, in a state of deep intoxication, may fall with his face in a gutter or ditch; he may die in this position, and

having the power to extricate himself. Even violence on his person must not be too hastily construed into proofs of murder. Not long since, a case of this description gave rise to a trial for murder in one of our midland counties. A man was found dead with his face in some melted snow; and there were several severe contusions on his body. The evidence showed that, after a quarrel, he left a neighbouring inn deeply intoxicated; and it was rendered extremely probable that he had perished accidentally on his way home. There was no reason to suppose that he had been murdered. Infants, from mere helplessness, may be drowned under similar circumstances. .

Drowning from partial immersion.—There is no doubt that murder by drowning may be perpetrated without the *whole of the body* being immersed in water. An interesting case of this kind, which was the subject of a criminal trial, was referred to me by Mr. Aldred, of Norwich, in March, 1841. The case was tried at the Norwich Lent Assizes of that year (*The Queen* v. *Yaxley*,) and the prisoner was convicted. It appeared that the mode in which the prisoner destroyed her infant child was by immersing its head for a few minutes in a pail of water. She removed it before it was quite dead, but it soon died with slight convulsive motions of the limbs. The case was rendered obscure by the fact that the whole of the body had evidently not been immersed; and the only conceivable means of drowning were in a small duck-pond adjoining the house, which was covered with weeds; but no weed was found in the stomach of the child, although a quantity of water was there present. The death of a child under these singular circumstances is, however, quite compatible with *accident*. Mr. Tubbs, of Upwell Isle, has communicated to me the following case, which fell under his notice in April, 1848. He was called to see a child æt. 18 months, which was stated to be dying. On his arrival at the cottage, he found it dead: the skin was cold, and the countenance calm and pale, with the exception of a livid discoloration in the centre of each cheek. The eyelids, as well as the mouth, were half open. The pupils were largely dilated. A frothy mucus, tinged with blood, was escaping from the mouth and nostrils. The tongue was swollen, and protruded forwards. The mother of the infant, a respectable woman, gave the following account:—She was washing in one room, while the child was in an adjoining room, the door between being kept open, by a pail half full of water. She went out of the house for about two minutes, and on her return she found the child with its head downwards in the pail of water, the heels and part of the body hanging over the side of the pail. She snatched it out and tried to revive it, but without effect. There was no reason to doubt the truth of her statement, and at the inquest the jury returned a verdict of accidental death. The helplessness of an infant at this age, and the rapidity with which asphyxia supervenes, sufficiently account for its death under these circumstances.

A case occurred in London, in 1841, where a drunken man was drowned by falling on the bank of the Surrey Canal, with his head partly in the water, while the greater part of his body lay on the bank out of the water. It was by partial immersion that the Italian boy, Carlo Ferrari, was destroyed some years since by *Bishop* and *Williams*, who afterwards attempted to sell the body for the purposes of dissection. The murderers first intoxicated the deceased, and then suspended him by the heels in a well, so that his mouth was but a few inches below the level of the water. A medical man, therefore, must not allow himself to be deceived respecting the cause of death on finding that the *whole* of the body has not been immersed. In this form of murder, when the inspection is recent, water with or without weeds or other foreign matters may be found in the ear-passages.

Ligatures on the hands and feet.—When a drowned subject is removed from water with the hands and feet bound by cords, it is usually considered that we have therein strong presumptive evidence of homicide; but numerous cases are recorded where suicides have actually bound themselves in this manner before

throwing themselves into water, probably for the express purpose of preventing any chance of their escaping death. In July, 1832, the body of a full-grown man was removed from the Seine, his neck, legs, and hands being secured together by a cord furnished with slip-knots. There was no doubt that he had died by drowning, and that the act was one of deliberate suicide, the cord having so placed on his body that an individual could easily place it on himself. In this case there was no great degree of ecchymosis produced by the cord: nor is it likely there should be, when it was arranged by a suicide, since his object would be merely that of rendering himself helpless by securing his arms and legs. This he would doubtless accomplish without giving himself much pain. If the marks bear the evidence of violent constriction, especially on both sides or on the fore part of the neck, the presumption of murder becomes very strong. In a case of this kind, it would be obviously of great importance to determine whether the deceased had really died by drowning or not; since, if his death had not been due to drowning, the fact of his body being discovered in water so bound, would furnish the strongest possible evidence of murder. (Ann. d'Hyg. 1833, i. 207.)

Weights attached to the body.—If a body be taken out of water with heavy weights attached to it, the question of *accident*, as in the former case, is done away with. It must be either homicide or suicide; and doubtless many would be apt to suspect that it was a case of murder. Several instances have, however, occurred where persons have committed suicide by drowning, and heavy weights have been found attached to their feet and hands, or in or about the dress.

Age.—Another question which may be considered is this:—Does the age of a drowned subject rebut the presumption of suicide, even when there is no other ground for suspecting murder? In the case of an *infant*, this question must assuredly be answered in the affirmative. If the body of a new-born child be discovered drowned in water, the case must be one of accident or murder. Murder is generally presumed by our law on the clear evidence that drowning was the cause of death; it is then for the accused party (commonly the mother) to satisfy the Court that the drowning was accidental. The discovery of any wounds, or other marks of wilful violence, would altogether do away with the presumption of accident. It must, however, be proved that the child died from drowning, since a woman may merely have placed its dead body in water for the purpose of concealment.

But we cannot so easily fix the age at which the suspicion of *suicide* will cease to be rebutted thereby. The question might arise on the discovery of the drowned body of a child not more than *three* or *four* years of age; and in this case suicide would be highly improbable. Such young subjects are often drowned by accident, but then there are facts usually forthcoming which remove all the difficulties from the investigation. The youngest age of *suicide* by drowning which I have met with was in a boy of 13: in two other cases of girls aged 12 and even 11, suicide by drowning was attempted. (Ann. d'Hyg. 1836. ii. 432.) After 13, suicide by drowning has been known to have been committed at every period of life up to the age of 86. Suicide by drowning is, however, almost as rare in advanced age as in extreme infancy.

HANGING.

CHAPTER LVIII.

CAUSE OF DEATH—RAPIDITY OF DEATH—DEATH FROM THE SECONDARY EFFECTS—TREATMENT—PERIOD AT WHICH DEATH TAKES PLACE—POST-MORTEM APPEARANCES—MARK OF THE CORD OR LIGATURE—UNECCHYMOSED MARKS—OTHER APPEARANCES—WAS DEATH CAUSED BY HANGING?—HANGING POST MORTEM—SUMMARY OF MEDICAL EVIDENCE—CIRCUMSTANTIAL EVIDENCE—MARKS OF VIOLENCE ON THE HANGED—WAS THE HANGING THE RESULT OF ACCIDENT, SUICIDE, OR HOMICIDE?—HOMICIDAL HANGING—INJURY TO THE CERVICAL VERTEBRÆ—THE POSITION OF THE BODY—THE LIMBS SECURED—POWER OF SELF-SUSPENSION.

Cause of death.—By hanging we are to understand that kind of death in which the body is wholly or partially suspended by the neck, and the constricting force is the weight of the body itself; while, in strangulation, the constricting force is due to some other cause. In both cases death commonly results from *asphyxia*, although this must depend in a great measure upon the position of the ligature on the neck. If this be loose, or applied to the upper part of the neck, a small quantity of air may still reach the lungs; and then the cerebral circulation becomes interrupted by the compression of the great vessels of the neck. In this case, apoplexy of the congestive kind is induced, and operates as the immediate cause of death. It is easy to conceive that there may be a mixed condition of asphyxia and apoplexy, and according to the observations of Professors Casper and Remer, this is actually met with in the greater number of instances. The following tables represent the results at which they have arrived from the examination of a large number of cases:—

	Remer.	Casper.
Apoplexy	9	9
Asphyxia	6	14
Mixed conditions	68	62
Total	83	85

It has been frequently observed, in the execution of criminals, that death does not constantly ensue within the same period of time; and we may probably best explain this fact by a reference to the greater or less degree of constriction produced by the ligature. If the rope should press upon the larynx or above that organ, the occlusion of the air-passages will not be so complete as if it pressed upon the trachea immediately below the cricoid cartilage. A slight degree of respiration might, in the former case, continue for a short interval, by which the life of the person would be prolonged; while in the latter, death would be immediate. If the trachea be in part ossified, the pressure of the cord is less perfect, and death will then take place more slowly. It has been supposed that the immediate cause of the stoppage of respiration was a pressure produced by the cord on the nerves of the neck; but it must be considered as very improbable that, under the circumstances in which hanging generally takes place, the cord should

exert any pressure on the nerves sufficient to produce death. In the greater number of cases of suicidal hanging, which are commonly unattended with much violence, the pressure on these nerves cannot obviously exist; and in violent hanging, the projection of the anterior parts of the neck must suffice to prevent these slender nervous filaments from becoming exposed to such a degree of compression as directly to impede the exercise of their functions.

There is an occasional cause of death in hanging, which appears to have been first brought to the notice of the profession by Louis. Having remarked that, in public executions, death sometimes took place with great rapidity, and in other cases more slowly, he was led to inquire into the circumstances. He found that in the cases of rapid death, the executioner was in the habit of giving a violent rotatory motion to the body of the criminal at the moment it was turned off, whereby a displacement of the dentiform process of the second cervical vertebra took place, so that the spinal marrow became suddenly compressed. This cause of death must be extremely rare: as a general rule, it is only likely to be observed in very corpulent subjects, where a long fall is given to the cord, and where much violence has been at the same time employed by the executioner. It is seldom met with in subjects criminally executed; and in cases of suicidal hanging it is so rare, that Devergie found the ligaments between the first and second cervical vertebræ ruptured only once in fifty-two cases. M. de la Fosse considers, from the observations which he has made on the subject, that, in violent hanging, the dentiform process of the second cervical vertebra is much more likely to be fractured than to become displaced, and he found this in the case of an executed criminal. On an examination of the body of this subject, he discovered that the first two cervical vertebræ had been completely separated from the remainder of the spinal column by the rupture of the intevertebral substance, and that they were firmly attached by their ligaments to the occipital bone. The dentiform process and body of the second vertebra were detached from the bony ring, but were still connected as usual with the anterior arch of the atlas. The spinal marrow had become compressed by the fractured portions of the vertebræ. Probably further observations would show that the injury to the spine is not always of the same nature, and that fractures of the vertebræ are really more frequent than simple luxations of the odontoid process; but in the mean time, we must admit that such injuries may occur in hanging, and that when they do occur, death must be very sudden. But death may proceed from mere effusion of blood on the spinal sheath, thereby giving rise to fatal compression. This is likely to happen when the head falls, or is bent suddenly backwards, so that the weight of the body is supported on the back of the neck. See an interesting case of this kind by Mr. Campbell de Morgan (post.)

Rapidity of death.—Death from hanging appears to take place very rapidly, and without causing any suffering to the individual. It is observed, that in those who are criminally executed there are often violent convulsions of the limbs and trunk. There is no reason, however, to believe that the individual suffers pain, any more than in the convulsions of an epileptic fit. On recovery there is an entire loss of consciousness of pain in both cases. The circulation of dark-coloured blood through the brain and spinal cord may account for these effects. Efforts to inspire are made for from one to two minutes after the closure or compression of the trachea. The diaphragm and intercostal muscles act spasmodically, but no air enters the lungs, and it is probable that in the act of hanging, part of the air contained in the organs is convulsively expelled. When the suspension of the body has only continued a few minutes, it has often been found impossible to restore life; and indeed the period at which resuscitation may take place will vary in different subjects according to circumstances. Supposing the hanging to be unattended with violence to parts about the neck, it is possible that some individuals might be resuscitated after five minutes' suspension or longer. Others, again, may not be recovered when they are cut down imme-

diately after suspension,—a fact which depends probably on the different degrees to which asphyxia or apoplexy has extended.

Death from the secondary effects.—It by no means follows that because we have succeeded in restoring the respiratory process, the individual is safe. Death often takes place by a fatal relapse at various periods after the accident. A case of this description has been published by Sir B. Brodie. A boy, æt. 17, was found hanging. When cut down he was insensible; his face livid, his lips of a dark purple colour, pulse not perceptible, pupils dilated and motionless. Artificial respiration was used, and in a quarter of an hour the diaphragm began to act. He breathed at irregular intervals with stertor, and with a rattling noise in the throat. The pulse became perceptible, but often flagging, and the surface of the body was cold. The countenance was still livid, but the pulse and breathing improved. At the end of another hour an attempt was unsuccessfully made to take some blood from the arm, and the patient was placed in a warm bath. The breathing was stertorous through the night, and in the morning twelve ounces of blood were taken from the arm, but there was no relief. He continued insensible, cold on the surface, and frothing at the mouth, and he died twenty-four hours after he was cut down. The body was carefully examined. The vessels of the brain were very turgid with blood:—this was the only morbid appearance. In another instance, a labouring man, who had hanged himself, was cut down in a state of insensibility. He lay for a considerable time breathing with apoplectic stertor, but eventually recovered. (Lectures on Pathology, 72.) Dr. Shearman has reported in the Lancet (Jan. 6, 1844,) a case in which a powerful athletic man, who had been committed to prison for theft, hung himself. He was found apparently dead, hanging by his own handkerchief. He was cut down, and seen by Dr. S. half an hour after the occurrence. The man was then apparently lifeless,—he neither breathed nor moved, nor had any perceptible circulation. The face and neck were much swollen and livid, and the ecchymosed mark of the cord was immediately below the thyroid cartilage: the fingers were bent, and the hands nearly clenched. His head was raised, the windows were thrown open, and blood abstracted from the arm, which was put into hot water, in order to increase the flow. In a few minutes the man began to breathe:—the bleeding was allowed to continue until the pulse was felt at the wrist, and the pupil contracted completely on the application of a lighted candle. The breathing was stertorous. Brandy and water were poured into the stomach, and warmth was applied to the extremities. In the course of a few hours he rallied very much,—his pulse had become firmer and quicker (130,)—his head was hot,—he was very restless, unmanageable, and violently convulsed in the arms and legs. Shortly before death he was calm, and spoke several times. He suddenly became exhausted, and died nineteen hours after he was found hanging. This was probably a mixed case of asphyxia and apoplexy. The medical treatment appears to have been very proper. The unsuccessful result may perhaps be ascribed to the injury sustained by the cerebral circulation from constriction of the neck. In hanging, as well as in drowning, therefore, a person may in the first instance recover, but subsequently die in spite of the best treatment.

[We remember two cases in which the patients were dangerously ill from fever resembling typhus, for several weeks, immediately after having been cut down and resuscitated from the effects of a voluntary suspension. There might have been other causes for the fever in each of the cases, but none existed that were not more likely to be predisposing than exciting causes.—H.]

Treatment.—Artificial respiration, cold affusion when the skin is warm, with the vapour of ammonia and other stimuli, may be employed on these occasions. If there should be much cerebral congestion on recovery, venesection may be resorted to. The introduction of oxygen into the lungs, or the application of electricity or electro-magnetism in the course of the spine, [or to the heart, taking great care to employ a gentle current,] might be attended with benefit; but much

will depend, as in drowning, upon the time at which assistance is rendered after the body has been cut down. The following case of recovery, in which, however, asphyxia was not complete, was reported in the Lancet, Nov. 1839. A robust woman, aged thirty-three, hung herself while slightly intoxicated. She was missed about ten minutes before she was found suspended to a bedstead, but how long she had been thus hanging it was impossible to determine. Medical assistance was rendered to her in about ten minutes after she had been cut down. She was then quite insensible,—her respiration slow and laborious, and her pulse barely perceptible. The countenance was pale,—there was no lividity: the lower jaw was depressed, the extremities were moderately warm, and the hands convulsively clenched,—the pupils were somewhat dilated, and barely susceptible of the stimulus of light. A dusky red mark, of a quarter of an inch in breadth, was distinctly observed encircling the upper part of the neck, forming an angle over the ramus of the jaw on the right side, where the knot of the ligature (a silk handkerchief) had rested; and in consequence of this the constriction was incomplete. The patient was twice copiously bled, mustard poultices were applied to the calves of the legs, hot water to the feet, and cold applications to the head. After thirty-two ounces of blood had been abstracted, in half an hour the breathing became stertorous, the pupils fully dilated, the lower jaw fell further, the sphincters became relaxed, and the patient appeared to be rapidly sinking. Ammoniacal liniment was rubbed on the chest, and the woman so far recovered in an hour as to be able to swallow: but although she was conscious of pain, she remained comatose until the evening, when she became perfectly sensible of surrounding objects. This was evidently a case of imperfect suspension, where, from respiration still continuing, there was every hope of recovery. The cerebral circulation had here become disordered.

In the following case, which occurred to Mr. Noyce, *cold affusion* speedily resuscitated the individual. A man had been hanging about two or three minutes when he was cut down, and in four or five minutes afterwards he was seen by Mr. Noyce. He had then ceased to breathe: his features were pallid, and the conjunctivæ injected with blood. The heart's action continued, although feebly; the pulse being about 80, and very weak. Artificial respiration was tried without any benefit, when cold affusion was resorted to. This, after a very short time, led to the complete establishment of respiration: at each affusion there was a deep inspiration. The man was bled to sixteen ounces, and he soon recovered his consciousness. (Med. Gaz. xxxvii. 75.)

This case bears out the views long since published by Sir B. Brodie, namely, that after respiration has ceased, the heart still continues to act, and to circulate dark-coloured blood, for a period of three or four minutes, to the brain and other parts of the system. The exact period of time will, however, depend on the strength of the individual. [And probably the temperature of his body and that of the surrounding atmosphere.—H.] It is on this ground that there is great hope of restoring the individual by artificial respiration. The dark-coloured blood acts as a poison, [through its carbonic acid] and slowly destroys life. (Lectures on Pathology, &c. 66—70.) In the after-treatment, it is advisable that blood should be only sparingly abstracted, to relieve any cerebral congestion; because the vital powers are much reduced under the circumstances. Convulsions, and even paralysis, have been observed to precede recovery in experiments on animals. [We are inclined to think that in a large majority of cases of suspended animation, whether from drowning, suffocation or strangling, it would be much more advisable to secure, if possible, an additional supply of red blood by the operation of transfusion than to abstract any blood whatever. Some few cases are benefited by the cautious withdrawal of black blood; but it must not be forgotten that the patient is in a state of asthenia, for want of reparative oxygenated red blood, to counteract the exhausting stimulus and other poisonous effects of the super-carbonated black blood.—H.]

Period at which death takes place.—We learn from those who have been resuscitated, as well as from experiments performed by individuals upon themselves, that asphyxia comes on in the most insidious manner in death from hanging; and that the *slightest constriction* of the trachea will speedily produce insensibility. (Devergie, ii. 370.) The symptoms of which the persons have been conscious were a ringing in the ears, a flash of light before the eyes, then darkness and stupor. The only profitable inference, in a medico-legal view, which can be drawn from observations of this kind is, that asphyxia is not only very rapidly induced, but that it supervenes under circumstances where it would not be generally expected to occur, *i. e.* when the body of the individual is in great part supported. M. Fleichmann found that a cord might be placed round the neck between the chin and os hyoides, and tightened either laterally or posteriorly without perceptibly interrupting respiration: but while the respiratory process was thus carried on, the face became red, the eyes prominent, and the head felt hot. These symptoms were followed by a sense of weight, a feeling of incipient stupefaction, and a hissing noise in the ears. On the occurrence of this last symptom, the experiment should be discontinued, or the consequences may be serious. The first experiment lasted two minutes; but in the second, owing to the cord by its pressure more completely interrupting respiration, the noise in the ears appeared in *half a minute*. When the pressure was applied on the trachea, the effect was *instantaneous*, but when on the cricoid cartilage it was not immediate. When it was applied between the os hyoides and the thyroid cartilage, or on the os hyoides itself, the period during which an individual could respire was extremely short; and this result was more striking when the act of expiration was performed at the moment of applying the pressure. The death of Scott, the American diver, in January, 1840, shows how very readily asphyxia may be induced by slight compression of the throat, even where a person might be supposed to have both the knowledge and the power to save himself. This man was in the habit of making public experiments on hanging, and had frequently before gone through them without danger; but on this occasion, it is probable that a slight shifting of the ligature from under the jaw-bone caused so much compression on the throat between the chin and larynx, as speedily to produce asphyxia. No attempt was made to save him until it was too late, and he was not brought to an hospital until thirty-three minutes had elapsed. He was allowed to hang thirteen minutes,—the spectators thinking that the deceased was only prolonging the experiment for their gratification! The very insidious and painless manner in which an individual who is suspended passes from life to death, is well illustrated in the report of the case of *Hornshaw*, published by Dr. Chowne. (Lancet, April 17, 1847, 404.) This man was on three occasions resuscitated from hanging,—a feat, which, like Scott, he had performed for public gratification. He stated that he lost his senses almost at once; that it seemed as if he could not get his breath, and that some great weight was attached to his feet; he felt that he could not move his hands or legs to save himself, and that the power of thinking was gone. It is not improbable that many persons have thus lost their lives by privately attempting these experiments, and their cases have been wrongly set down as cases of suicide. There is, I think, no doubt that boys have thus frequently but unintentionally destroyed themselves out of a strange principle of imitation or curiosity. The following is one among many cases of this kind. In August, 1844, a boy, aged fourteen, witnessed an execution at Nottingham, and he was afterwards heard to say he should like to know how hanging felt. On the same afternoon, he was found suspended by a cord from a tree, quite dead; and from the circumstance there could be little doubt that he had been experimenting on the theory and practice of hanging, and that he did not intend to destroy himself. The jury returned a verdict of "accidental hanging."

Post-mortem appearances.—The following *external* characters of the body are

laid down as indicative of hanging by most medico-legal writers. Lividity and swelling of the face, especially of the lips, which appear distorted;—the eyelids are swollen, and of a bluish colour; the eyes red, projecting forwards, and sometimes partially forced out of the orbitar cavities;—the tongue enlarged, livid, and either compressed between the teeth or frequently protruded:—the lower jaw is retracted, and a sanguineous froth sometimes exists about the lips and nostrils. There is a deep and ecchymosed impression around the neck, indicating the course of the cord, the skin being occasionally excoriated;—laceration of the muscles and ligaments in the hyoideal region;—laceration or contusion of the larynx or of the upper part of the trachea. There are also commonly circumscribed patches of ecchymosis varying in extent about the upper part of the trunk and the upper and lower extremities, with a deep livid discoloration of the hands. The fingers are generally much contracted or firmly clenched, and the hands and nails are livid. The urine and fæces are sometimes involuntarily expelled at the moment of death. Internally, we meet with the appearances described under the head of asphyxia. The right side of the heart, and the great vessels connected with it, are commonly distended with blood. But when the inspection has been delayed for several days, this distention may not always be observed. The vessels of the brain are commonly found congested; and, in some rare instances, it is said extravasation of blood has been met on the membranes and in the substance of the organ. Extravasation of blood is, however, so rare, that Remer found this appearance only once among one hundred and one cases; and in one hundred and six cases, observed by Casper, it was not found in a single instance. In one case of death from hanging, Sir B. Brodie found a large extravasation of blood in the substance of the brain; and he refers to another case, in which there was a considerable extravasation between the membranes. (Lectures on Pathology, 58.) The venous congestion of the cerebral vessels is rarely greater than in other cases of asphyxia, and is probably dependent on the degree to which the lungs have become engorged. In most instances there is increased vascularity of the substance of the brain, so that, on making a section of the hemispheres, a greater number of bloody points than usual will appear. [Care must be taken, if possible, to distinguish these appearances from those which are said to arise from concussion of the brain. In the latter case the points of blood are minute extravasations of fluid blood, while in the former they are divided blood vessels filled with coagulated blood generally, and distinguished by the ease with which the small clots may be removed. The distinction is a difficult one, however, and perhaps not yet fully established—Dr. Bright was the first to point it out. See B. and F. Med. Chir. Rev. Jan. 1853, 68,—H.] In addition to these morbid changes, a mucous froth, sometimes of a sanguineous hue, has been described to exist in the trachea; but this is only likely to be met with in cases in which the obstruction to respiration has been incomplete. A more important circumstance has been noticed by Dr. Yelloly, namely, that in examining the stomachs of five criminals who had been hanged, he found great congestion in all; while there was blood extravasated and coagulated upon the mucous membrane in two. Such an appearance might, it is obvious, be attributed in a suspicious case to the action of some irritant substance. (See Ann. d'Hyg. 1830, 166; 1835, 208; 1838, 471.)

These external post-mortem appearances have been chiefly derived from the examination of the bodies of executed criminals. Such well marked characters are not generally met with in cases of *suicidal* hanging; and therefore it will be proper to state what are the principal differences. Thus, the face is sometimes pale,—a condition commonly seen in those cases in which there has been but little obstruction to the cerebral circulation, either from the softness or looseness of the ligature. Esquirol found, in one instance, that when the body was examined immediately after death, the face was not livid; but it first began to assume a violet hue in eight or ten hours. He thought that when the cord was

left round the neck the face would be livid; but, if removed immediately after suspension, pale. This view is not, however, borne out by observation. The tongue is not always protruded. Devergie found that there was protrusion of this organ only in eleven cases out of twenty-seven. This protrusion was formerly supposed to depend upon the position of the ligature:—thus it was said when this was below the cricoid cartilage, the whole of the larynx was drawn upwards, and the tongue carried forwards with it, while, when above the os hyoides, the tongue was drawn backwards. The protrusion or non-protrusion of the tongue does not depend upon any mechanical effect of this kind, but simply upon congestion; for it is occasionally met with thus protruding in cases of drowning and in other forms of asphyxia. Besides, the protrusion has not been found to have any direct relation to the position of the ligature.

Mark of the cord or ligature.—The most striking external appearance, however, is the *mark* produced on the neck by the ligature. The skin is commonly depressed, and sometimes ecchymosed, but rarely throughout its whole extent: it is very frequently free from all traces of ecchymosis, the skin in the depression being then hard, brown, or of a *parchment colour* and consistency, or there may be only a thin line of ecchymosis in the upper or lower border of the depression. The course of the mark is generally oblique, being lower in the fore part than behind. If the noose should happen to be in front, the mark may be circular, the jaw preventing the ligature from rising upwards in the same degree before, as it commonly does behind. The mark is generally single, but we may meet with it double, as where the ligature has been formed into two circles or loops previously to its application. Its other characters will depend upon the nature of the ligature employed. Thus a large and wide ligature rarely produces ecchymosis,—the mark is wide and superficial, but a small ligature produces a narrow and deep impression, sometimes accompanied with laceration of the cuticle and effusion beneath the skin. From the statistical returns of Devergie and Casper, it would appear that a cord or rope is employed in more than one-half of all the cases of hanging which occur. In other instances various articles of dress were fonud to have been employed.

Medical jurists have considered it proper to examine into the position of the ligature, as this may sometimes form a question in cases of suspected murder by hanging. The following table will show that in more than two-thirds of all cases of suicidal hanging, the ligature is found encircling the neck between the chin and os hyoides.

	Remer.	Devergie.	Casper.
Above the larynx	38	20	59
On the larynx	7	7	9
Below the larynx	2	1	0
	47	28	68

Unecchymosed marks or depressions.—It was formerly believed, that the impression produced by the cord was invariably ecchymosed, but more correct observation has shown that this is probably the exception to the general rule. When ecchymosis does exist, it is commonly superficial, and of very slight extent. There is rarely, if ever, effusion of blood in the cellular tissue. Dr. Riecke, of Stuttgard, in his observations on hanging, found only once in thirty cases an extravasation of blood beneath or on both sides of the depression produced by the ligature. The tongue was generally between the teeth, and in most cases wounded by them. He attributed death to stretching of the spinal marrow. (Henke's Zeitsch. 1840, 27 Erg. H. 332.) In the bodies of individuals who have been criminally executed, it is not unusual to find ecchymosis; buteven here it is not always present. In a case which I had an opportunity of examining some years since, there was only a slight trace of ecchymosis in

one spot where the knot in the cord had produced contusion. That it should commonly occur in criminal executions is not surprising, considering the violence employed on these occasions; but it has been somewhat too hastily assumed that these appearances in executed criminals are met with in all cases of death from hanging. This doctrine has been carried so far, that a *livid mark* in the course of the cord has been pronounced to be the best criterion for distinguishing hanging in the living from hanging in the dead body! It will be seen, however, that no reliance can be placed on this appearance. In fifteen cases examined by M. Klein, in twelve examined by M. Esquirol, and in twenty-five cases of suicidal hanging which occurred to M. Devergie (op. cit. ii. 394,) there was no ecchymosis whatever in the course of the ligature. (Annales d'Hyg. 1832, 413; 1842, 146.) Out of six cases, Fleichmann met with only one instance. In three cases of suicidal hanging which I have had an opportunity of examining, no ecchymosis had been produced by the ligature. In all of these instances, the skin, instead of being blue or livid, or presenting effusion of blood in the cellular tissue beneath, was hard and of a *yellow colour*, resembling parchment. It had that appearance which the cutis commonly assumes when the cuticle has been removed from it for two or three days; and on dissecting it off, the cellular membrane beneath often appears condensed and of a silvery whiteness. In some instances, the mark, instead of being livid or brown, has presented itself simply as a white depression. This has been observed in very fat subjects. [Our experience in regard to the mark in a number of cases of suicidal hanging, coincides with that of Dr. Taylor.—H.] The observations of Casper on this point are as follow:—Out of seventy-one cases, there was no ecchymosis produced by the cord in fifty; and thus in two-thirds of the cases examined it was entirely absent. Casper also found that there was no difference in the result, whether the ligature was removed sooner or later after death. Remer considers ecchymosis in the course of the cord to be a frequent appearance in hanging; but Devergie very properly objects to the inference which he has drawn from his cases (op. cit. ii. 397.)

The following singular case, which occurred to Dr. Hinze, of Waldenburg, will show that the presence of ecchymosis in the mark does not depend, as Esquirol supposed, on the ligature being left around the neck. A young man in a fit of drunkenness hung himself with a stout cord. In about half an hour afterwards, he was cut down, and attempts were made to resuscitate him. It was perceived that the cord had merely produced a superficial impression on the neck, destitute of any appearance of ecchymosis. Signs of returning life began to manifest themselves:—the attempts at resuscitation were continued for several hours, but all signs of vital reaction disappeared; and now, when life was about to become again extinct, to the astonishment of those present, the mark on the neck, which had been hitherto colourless, became deeply ecchymosed. On an inspection being made the next day, it was found that this ecchymosis continued; and that it was owing to a real subcutaneous effusion. From the appearances in the head, it was concluded that the deceased had died from congestive apoplexy.

Other appearances.—Injuries to the muscles and deep-seated parts of the neck are, of course, only likely to be seen where considerable violence has been used in hanging. In one or two instances, the lining membrane of the common carotid artery has been found lacerated. Congestion and tumefaction of the genital organs in either sex, have been set down among the common consequences of hanging;—but many observers have never met with these conditions; and it is doubtful whether, unless the body be examined speedily after suspension, any marked difference would be discovered. A more common sign, perhaps, is the discharge of the spermatic secretion in the male; but according to Casper, it is the mucous secretion of the prostate gland which is thus discharged at the moment at which death takes place. He states that traces of this are met with in

from one-third to one-fourth of all cases of death from hanging in the male. It appears to me that very little reliance can be placed upon evidence derivable from this sign, and yet it has sufficed to give rise to a most violent controversy among French medical jurists. (Annales d'Hygiène, 1839, i. 169, 467; ii. 393; 1840, ii. 314.) It is, I think, clear that unless death from hanging be strongly established by other facts, neither the examination of the linen of the deceased, nor the application of the microscope to the mucous fluid found in the urethra, would be of any practical value in elucidating the question,—at least to the satisfaction of an English jury. M. Donné justly considers evidence of this kind to be a piece of scientific refinement, in which, by attempting to prove too much, we prove nothing. Spermatic fluid may be found in the urethra of a person who has died from natural causes; and Donné has ascertained that the ejaculation of a portion of this fluid into the urethra may even take place in a subject hanged up after death. He has found the fluid in some of these cases to contain living zoosperms. (Cours de Microscopie, 303.) For some remarks on the relative frequency of these appearances, see Med. Gaz. xliv. p. 84.

Summary.—The following may be regarded as a summary of the post-mortem appearances, when death has taken place from asphyxia. The countenance is livid, or sometimes pale, the eyes are prominent, the tongue congested and occasionally protruded, the lower jaw retracted:—the skin is covered with patches of cadaverous ecchymosis: the hands are livid and clenched,—an oblique mark is found on the neck,—sometimes presenting traces of ecchymosis: commonly, however, the skin is only brown in colour and hardened. The larynx, trachea and subjacent muscles, are lacerated, depressed or discoloured. The vessels of the brain are congested, as well as those of the lungs and the right cavities of the heart. A mucous froth is occasionally found in the trachea. These appearances will of course be modified, or they may be altogether absent, when death has taken place from disorder of the cerebral circulation, or from injury to the spinal marrow, either by effusion of blood, fracture, or displacement.

Was death caused by hanging?—When a person is found dead and the body suspended, it may be a question whether death really took place from hanging or not. In investigating a case of this kind, it is necessary to draw a distinction between the *external* and *internal* appearances of the body. The former alone can assist us in returning an answer to this question,—the internal appearances of the body can only enable us to say whether any latent cause of death existed or not. The microscopical examination of the blood as contained in the vessels above and below the seat of constriction, has failed to throw any light upon this question. (See Med. Gaz. xxxviii. 1042.) Neither the state of the countenance or skin, nor the position of the tongue, can afford any evidence on the subject of death from hanging.

Evidence from the mark of the cord.—It is to the *mark* produced by the cord on the neck, that medical jurists have chiefly looked for the determination of this question. The form, position, and other characters of this mark, having been already described, it will be only necessary to allude to it, as furnishing evidence of life at the time of its production. It has been stated, that so far from being constantly livid or ecchymosed, this condition is, in reality, not seen in more than one-half of the cases which occur. But admitting that we find ecchymosis in the course of the ligature, are we always to infer that this must have been applied while the individual was living? The case which occurred to Dr. Hinze, (p. 493) proves that the presence of active life is not necessary for the production of an ecchymosis in the mark; and from the experiments of Devergie, it would appear that if a subject be hanged immediately or a short time *after death*, an ecchymosed mark may be produced by the application of a ligature to the neck (op. cit. ii. 408.) If a few hours were suffered to elapse, so that the body had become cold, no ecchymosis was produced by the ligature. Professor Vrolik, of Amsterdam, found that a slightly livid mark was produced on the

neck of a dead body, which had been suspended *an hour* after death. (Casp. Woch. Feb., 1838.) Hence this condition of the mark in a body found dead indicates either that the deceased must have been hanged while living, or very soon after the breath had left his body. It would be for a jury to decide between these two assumptions; and to consider why, when a man had really died from other causes, he should have been hanged in secrecy immediately after death. (See Ann. d'Hyg. 1842, i. 134.) The circumstance that an ecchymosed mark may be produced by suspending a recently dead subject, bears out the statement of Merzdorff—that it would be in the highest degree difficult, if not utterly impossible, to determine medically, from an inspection of the body, whether a man had been hanged while living, or whether he had been first suffocated and hanged up immediately after death. In making this admission, it is proper to bear in mind, that that which is difficult to a conscientious medical jurist, is often very easily decided by a jury from the general evidence afforded to them.

Sometimes, besides ecchymosis, there are excoriations of the skin in the course of the cord; and these are known to be *vital* by the effusion of blood. Devergie never met with this appearance in the dead body even when the hanging took place immediately after death. The discovery of effused coagula in or about the spinal column, would render it very probable that the deceased must have been hanged while living. Such marks of violence are, however, rare in cases of hanging; and when they are found, it might be assumed that the effusion and coagulation of blood had been caused by violence offered to the neck *immediately after death;* but this assumption may be met by the question already suggested, namely, why death by hanging should be simulated in the body of a person who was alleged to have died from another cause!

With regard to the other, or more common kind of mark in suicidal hanging, it can scarcely be said to furnish any evidence in relation to the question which we are here considering. The depression may be hard and brown, although it does not usually acquire this colour until some hours have elapsed after death; for it appears to depend simply upon a desiccation of the portion of skin which has been compressed by the ligature. Sometimes the upper and lower borders only of the depression, present a faint line of redness or lividity; and it is worthy of remark that, when the ligature presents any knots or irregularities, those portions of skin which sustain the greatest compression are white, while those which are uncompressed may be found more or less ecchymosed. It is in this way that the form of the ligature is sometimes accurately brought out. It may be remarked of these depressions produced by the cord, that the characters which they present are the same, whether the hanging take place during life or soon after death:—the appearances may be very similar in the two cases.

Hanging post-mortem.—The following are the results of some experiments performed by Casper:—1. A man, aged twenty-eight, was suspended an hour after death by a double cord passed round the neck above the larynx. The body was cut down, and examined twenty-four hours afterwards. Between the larynx and os hyoides, there were two parallel depressions about a quarter of an inch deep—the skin having a brown colour with a slight tinge of blue, and leathery consistency: in certain parts it was slightly excoriated. There was no extravasation of blood beneath, but the muscles which had undergone compression were of a dark purple colour, and the blood-vessels of the neck were congested. The appearance of this subject was such, that any individual unacquainted with the facts, would have supposed, on looking at it, that the person had really been hanged while living. There was nothing to indicate that the hanging had taken place an hour after death. 2. The body of another young man was hanged an hour after death, and an examination was made the following day. The two impressions produced by the double cord were of a yellowish brown colour, without ecchymosis. The skin appeared as if it had been burnt or cut, and felt like parchment. 3. An old man who had died from dropsy was hanged two hours

after death. The impressions presented exactly the same characters as in the preceding case. (Wochenschrift für die G. H., Januar, 1837.) When the constriction took place at a later period after death, there was no particular effect produced.

We learn from these experiments, as well as from those performed by other observers, that the mark which is most usually seen in vital hanging, (non-ecchymosed,) may be also produced by a ligature applied to the neck of a subject *within two hours* after death,—consequently the presence of this mark on the neck is no criterion whether the hanging took place during life or after death. The changes in the skin beneath the mark are also destitute of any distinctive characters: there is the same condensation of the cellular membrane, whether the hanging have occurred in the living or dead. These changes are the simple result of a physical cause,—mechanical compression.

Summary of medical evidence.—From the foregoing considerations, we draw the conclusion that there is no distinctive sign by which the hanging of a *living* person can be determined from an inspection of the dead body. All the external marks may be simulated in the *dead* subject, and the internal appearances furnish no evidence whatever. Still, when the greater number of the signs enumerated are present, and there is no other satisfactory cause to account for death, we have strong reason to presume that the deceased has died from hanging. We must not, however, abandon medical evidence on these occasions, merely because plausible objections may be taken to it. Facts may show that, however valid such objections may be in the abstract, they are wholly inapplicable to the particular case under investigation. Perhaps the greatest medical difficulties occur in reference to cases of *suicide*, owing to the slight appearances which here attend this form of death; but on these occasions, moral and circumstantial proofs are so generally forthcoming, that even an inspection of the body is scarcely ever deemed necessary by a coroner! If, then, it be admitted by a medical jurist, that it is not in all cases possible to distinguish hanging in the living from hanging in the dead, the admission must be considered as having reference to cases wherein individuals destroy themselves, and not to cases where they are destroyed by others. Even if a doubt were raised in any particular instance, it is more than probable that circumstantial evidence would furnish data for a decision, and thus satisfactorily make up for the want of ordinary medico-legal proofs. If, when we found a deeply ecchymosed mark around the neck of a dead subject, we said, all other circumstances being equal, that the individual had most probably died by hanging, we should not be departing from a proper discharge of our duty; since, although it is medically possible that such a mark may be produced after death, yet as it would be only a murderer who would think of hanging up a recently dead body to simulate suicide, so it is certain, that in such a case we should most probably find some very obvious indications of another kind of violent death about the person. The absence of these, and the presence of ecchymosis in the course of the cord, would, it appears to me, leave the question of vital hanging decidedly settled in the affirmative. It is necessary that great caution should be used in expressing an opinion that the hanging probably took place after death, merely from the absence of ecchymosis in the seat of the ligature; because, while this is generally true, it may in particular cases lead to the concealment of the real mode of death. Many facts already adduced show that numerous cases of hanging during life would be pronounced to be post-mortem, if this were taken as a criterion. The mere discovery of violence about the person is not of itself sufficient to rebut the presumption of death from hanging on these occasions. The violence should at least be of such a nature as to account for the immediate destruction of life, or it can throw no light upon the question whether the individual might not have died from hanging, in spite of the marks of maltreatment found upon the body.

If, in the case of a person found hanging, a medical jurist should assert that

death had *not* taken place from that cause, this would be tantamount to declaring that the deceased must have been murdered:—because it is impossible to admit that any but a murderer would hang up a recently dead person. This has been frequently done for the purpose of concealing the real means of death, and making the act appear to be one of suicide. The following case is reported by Deveaux. A female was found suspended to a beam in a barn. From the absence of all the marks of hanging about the face and neck of the deceased, a careful examination of the body was made. In the course of the inspection, a small penetrating wound, evidently inflicted by a round instrument, was discovered on the right side of the chest, but in great part concealed by the mamma of that side. On tracing the wound, it was found to pass between the fifth and sixth ribs, completely perforating the heart from the right to the left side. A considerable extravasation of blood had taken place internally, which had been the cause of death. It was therefore evident, from the result of this examination, that the deceased had been killed, and her body suspended after death. (For a precisely similar case by Prof. Vrolik, see Casper, Woch. Feb. 1838.) Foderé refers to a case in which an individual was found hanging under somewhat similar circumstances, and on examination it was discovered that death had been caused by the administration of poison,—the body having been subsequently suspended. In one instance Devergie discovered a quantity of plaster of Paris in the stomach and intestines of a person found hanging. There are, however, cases in which some embarrassment may occasionally arise. It may be a question whether the discovery of poison in the body of a person found hanging, is not incompatible with previous attempts at suicide by poison. An individual has even been known to hang himself after or about the time that he had swallowed a strong dose of prussic acid. (See ON POISONS, 662.)

Circumstantial evidence.—Circumstantial evidence has more than once assisted in clearing up a doubtful case. Louis states that on removing the body of a man who was found hanging, the rope was observed to be clotted with blood. This simple circumstance led to further investigation, by which it was discovered that the person had been murdered, and his body afterwards suspended. The presence of marks on the neck indicative of strangulation, such as the cord was not likely to have produced, may lead to a suspicion that the hanging followed death. In April, 1829, a boy was found hanging perfectly dead. On inspecting the body, a round ecchymosed mark, about the size of a dollar, was seen on the fore part of the neck; and near it were several impressions as of fingers in the surrounding skin. There was neither depression nor ecchymosis in the course of the cord. The inspection left no doubt that the deceased had died from asphyxia. It was subsequently discovered that the boy had been first strangled, and afterwards hanged. In another case a man was found hanging in a room. His body was so suspended from a hook, that the trunk was not more than nine inches from the floor; and his legs were stretched out at length. The cord was from two to three feet long, and but loosely passed round the neck. The furniture of the room was in great disorder, and some marks of dried blood were seen on one part of the floor. The right side of the head and face of the deceased presented several excoriated and ecchymosed marks. There was a circular impression around the neck produced by the cord; but it was entirely free from ecchymosis. On the left side, a little above this impression, there was a strongly ecchymosed mark, which could be traced round to the back of the head. Blood was found extravasated beneath this mark. The lungs presented the characters of asphyxia, but the examiners referred this to strangulation and not to hanging, considering that the body had been suspended after death in order to give the appearance of suicide. Had there been an ecchymosed mark on the neck, which could not have resulted from the suspending cord, the case would have remained, medically speaking, doubtful; because it is well known that the affirmative signs of hanging may be absent, and yet the individual may thus have died. (See the case of *Pinckard*, STRANGULATION, post.)

Marks of violence on the hanged.—The presence of marks of violence on the body of a hanged person is important; and it will be proper for a witness to notice accurately their situation, extent, and direction. Having satisfied himself that they must have been received during life, he will have to consider the probability of their being of accidental origin or not. These marks of violence are not always to be regarded as furnishing unequivocal proofs of murder; for it is possible that they may have been inflicted by the individual himself before hanging, and not succeeding in committing suicide by these attempts, he may subsequently have resolved to accomplish his purpose by suspending himself. Let the witness duly reflect on these circumstances before he allows his opinion to implicate any party,—let him consider that a hanged subject may bear the marks of a gun-shot wound, his throat may be cut, his person lacerated or disfigured, and yet before a suspicion of homicide is allowed to be entertained, it ought to be clearly shown that such injuries could not, by any probability, have been self-inflicted. The importance of observing caution in such a case will be still more manifest, when there is no ecchymosis produced by the cord, and the face does not present the usual characters of hanging. Marks of violence on a hanged subject may in some cases be fairly ascribed to *accident*. If the individual have precipitated himself with any violence from a chair or table in a furnished apartment, he may have fallen against articles of furniture, and have given rise to lacerations and contusions, especially on the extremities. Again, it is possible to imagine that the rope may have given way, and the individual, in falling, have injured his person; but he may afterwards have had resolution enough to suspend himself again. Such an occurrence may be rare; but when the presence of these injuries is made to form the chief ground of accusation against a party as the murderer, their accidental origin ought not to be lost sight of by a considerate witness. If we suppose the person to have been hanged in a state of intoxication or stupefaction, medical evidence alone will rarely suffice to determine the question of homicide or suicide. The absence of all marks of violence from the body might actually lull suspicion. It is proper on these occasions to look to the hands of the deceased, since it is with these that a person defends himself; and, unless taken unawares, it is almost certain, if the hanging were homicidal, that there would be traces of violence on these parts. The clothes would be torn and discomposed, and the whole appearance of the deceased would be that of one who had done his utmost to resist a violent murderous attack. There are some injuries which could not be attributed to accident under the circumstances. Among these we may enumerate fractures, dislocations, deeply penetrating incised or gun-shot wounds. Now the question is, Do these serious injuries necessarily establish homicide? The answer must be in the negative; although, where fractures or dislocations exist, there are very strong grounds for suspicion.

Suicides, it must be remembered, are capable of making many attempts on their lives by various means. In the spring of 1836, a gentleman was found dead, hanging in his bed-room at an inn. His dress was much disordered, and blood, which had issued from a deep wound in his throat, was found scattered over the floor. From the facts proved, there was no doubt that this had been an act of suicide; and that the deceased, previously to hanging himself, had first attempted to cut his throat. Had this body been found in an exposed situation, this wound in the throat might have given rise to a suspicion of murder. The following somewhat remarkable case occurred at Walworth in 1836. A young man was found hanging in his bedroom, quite dead. He was suspended by his cravat, and his feet were within an inch of the floor. The door of the room was fastened on the inside, and it was proved that no one could have had access to it. An earthen pan was found near the bed, containing about a pint of blood, which appeared to have proceeded from a very deep incision in the bend of the left arm of the deceased. The razor with which this had been inflicted was found

on the mantelpiece. It came out in evidence, that on the night previously the deceased had swallowed a quantity of arsenic, and had suffered severely from the effects of the poison; although at the time it was supposed that his illness was due to other causes. In this case there were three modes by which suicide was attempted. The deceased had first taken poison, then wounded, and afterwards hanged himself. There could be no doubt that death was caused by hanging; and had the wound been inflicted, and the poison administered by other parties, this opinion might have been safely expressed. Had the body been found hanging in a suspicious locality, these circumstances would have created a strong presumption of murder. The following case is reported by M. Dégranges: —A man was found hanging in a room by a cord attached to a nail in the ceiling. In the upper and fore part of his neck there was a deep wound, through which the cord passed. A ladder was placed against the wall by the side of the body. About a pound of coagulated blood was found on the floor, as well as in different parts of the apartment; and some linen, covered with blood, was discovered near the body. In a table-drawer, in the apartment above, was found some cord sprinkled with blood, as if a bloody hand had been searching in it. On the staircase between the two apartments there was no trace of blood. The deceased's apartment was secured on the inside by the door being bolted. An opinion was demanded of the reporter respecting the manner in which the deceased had died, and the probability of his having been murdered.

The deceased's clothes were spotted with blood, and his hands were also bloody. The body externally did not present the *slightest* trace of any ecchymosis or other mark of violence. The hands were likewise free from violence; the fingers contracted, and the nails blue. There were patches of cadaverous lividity scattered over the trunk; and it was evident that the fæces had been discharged. The face had a slight violet tint, and the tongue projected about an inch from the mouth. This organ had been forcibly compressed by the teeth. The wound in the throat was situated between the chin and os hyoides, and extended from the angle of the jaw on one side to the opposite angle. It had penetrated through the cavity of the mouth to the pharynx, but had only divided some small branches of the thyroideal artery: it had evidently been inflicted after several attempts, for its edges were irregularly cut. The cord, in passing through the wound, had lacerated and extended it at the two extremities. The cerebral vessels were filled with blood; the cervical vertebræ were uninjured, and the stomach was free from any trace of poison. The opinion given from these data was to the effect, that the deceased had died from hanging, and that he had hanged himself.

When we consider that in this case the deceased had laid open his throat as far as the vertebral column, dividing the right superior thyroideal artery, by which so much blood had been lost that it was not unlikely he would have soon fallen into a state of syncope, it is remarkable that he should have had sufficient presence of mind and muscular power to have done what the evidence shows he *must* have done, namely, to have placed a handkerchief on his wound in order to arrest the hemorrhage; to have gone up stairs to another room, and have searched in a table drawer for the cord with which he intended to hang himself; to have placed a ladder against a wall, and to have made use of this for the purpose of fixing a cord to a nail in the ceiling, an act which could only be accomplished with great difficulty. When we duly reflect on all these circumstances, it does not appear extravagant that the magistrate who ordered the examination should have been prepared to receive an account of the deceased having been murdered. A great deal, it is true, rested upon the moral and circumstantial proofs; as, for example, on the previous state of mind of the deceased, and the fact of his room having been found secured on the inside.

The remarks made relative to incised wounds will also apply to gun-shot wounds. A suicide may attempt to destroy himself with a pistol; he may fail in the attempt, and ultimately hang himself. Any description of a gun-shot

wound, provided it be such as to allow of the individual surviving a sufficient time, may thus be found on a hanged subject, and yet constitute no proof whatever of homicide. If there be circumstances about the wound or injury which prove that it could not have been self-inflicted, this of course alters the question; but where such circumstances are not met with, the cautious medical jurist should say, in answer to inquiries respecting the origin of these wounds, that they may have been inflicted either by the individual himself or by *another*. There might be no medical facts which would directly establish either view. Of course, if, in any case, the wounds or injuries be of a decidedly mortal nature, and have probably caused death, the presumption of murder amounts almost to positive certainty; for who but a murderer would suspend the dead body of a person so wounded *immediately* after death? (Ann. d'Hyg. 1835, ii. p. 410.) In one instance of suicidal hanging, there were lacerated wounds upon the head, and a handkerchief was found blocking up the mouth. (Henke's Zeitschrift, 1838, ii. 257; 1839, i. 207; also 1840, i. 135; also B. and F. Med. Rev. No. xxiv. p. 560.)

Was the hanging the result of accident, homicide, or suicide?—Most medical jurists have passed over the subject of *accidental hanging*, probably believing it to be impossible. In the sense commonly implied by the term, it is certainly unusual, but although rare, it is a possible occurrence. Dr. Smith mentions a case, which occurred some years since, in which a girl of the age of thirteen was hanged by pure accident. She was swinging in a brewhouse, and near the rope used by her for that purpose, was another for drawing up slaughtered sheep. In the course of the exercise, her head got through a noose of this second cord, which pulled her out of the swing, and kept her suspended at a considerable height until dead. The following case was communicated to me by one of my pupils. In December, 1833, an inquest was held on the body of a boy aged ten years. It appeared in evidence that he had been playing with a child eight years old, who was the only witness of his death. The deceased had been amusing himself in swinging by fastening a piece of plaid gown to a loop in a cord which was suspended from a beam in the room. In the act of swinging, he raised himself up, and gave himself a turn, when the loop of rope suddenly caught him under the chin, and suspended him until life was entirely extinct. The boy who was in the room with him did not give any alarm for some time, thinking that the deceased was at play. The jury returned a verdict of "accidentally hanged." Another case occurred in London in 1836. A man who was in the habit of exercising himself in gymnastics on the rope, was one morning found dead and suspended in his bed-room. The rope had passed twice round the body and once round the neck, whereby it had caused death, although the legs of the deceased were resting on the floor. There was no doubt that the deceased had been accidentally hanged. These are two among several instances which have come to my knowledge, and it will be seen that the circumstances under which they occurred were sufficiently decisive of the manner in which the hanging took place. Indeed, circumstantial evidence must always suffice for the discrimination of accidental hanging; and we have therefore merely to inquire whether, when an individual is found hanging under circumstances which do not allow of the suspicion of accident, the act be the result of *suicide* or of *homicide*. The medical witness must remember that this is strictly a question for the jury. It is not for him to say whether a man has hanged himself or been hanged by others, but merely to state, when required, those *medical circumstances* which support or rebut one or the other presumption.

Homicidal hanging.—It has been very truly observed, that of all the forms of committing murder, hanging is one of the most difficult, and it is, therefore, but seldom resorted to. In most cases where an individual has been hanged by others, it has been after death, in order to avert the suspicion of homicide. Hence the discovery of a person hanging affords primâ facie evidence of suicide, supposing it to be rendered absolutely certain that death has taken place in this

manner. We must, however, admit that an individual may be murdered by hanging, and the appearances about his body will not afford the smallest evidence of the fact. The circumstances which will justify a medical jurist in making this admission are the following. First, when the person hanged is feeble, and the murderer a strong, healthy man. In such a case, a child, a youth, a female, or an individual at any period of life, worn out and exhausted by disease or infirmity, may be in this way murdered. Secondly, when the person hanged, although usually strong and vigorous, is at the time in a state of intoxication, stupefied by narcotics, or exhausted by his attempts to defend himself. Thirdly, in all cases murder may be committed by hanging when many are combined against one individual. With these exceptions, then, a practitioner will be correct in deciding, in a suspected case, in favour of the presumption of suicide. Unless the person labour under stupefaction, intoxication, or great bodily weakness, we must expect, in homicidal hanging, that there will be evident marks of violence about the body; for there are few who would allow themselves to be murdered without offering resistance; notwithstanding the assertion of Mahon, that some might submit to this mode of death with philosophical resignation when they saw that resistance was hopeless! The following singular case of attempted murder by hanging is mentioned in Symes' Judiciary Reports, Edinburgh, 1827. A woman, aged sixty-nine, was charged with attempting to hang her husband, who was some years older. It appeared that the prisoner contrived to twist a small rope three times round the neck of her husband, while he was lying asleep. She then tied him up to a beam in the room in such a manner that when the neighbours entered he was found lying at length on the floor, with his head raised about one foot above it. He was quite insensible; his hands were lying powerless by his side, his face was livid, and it was some time before he could be roused. Had he remained three minutes longer in this position, he would have died. According to his statement, he went to bed quite sober, and he was not aware of any thing which passed during the attempt to hang him, or afterwards, until he was resuscitated. The prisoner was convicted of the assault without previous malice, she having had no ill-will against her husband, and being at the time intoxicated. It can hardly be considered possible that any man should be so sound asleep as not to be awakened by the attempt thus made to hang him. The probability is, that the prosecutor was, like his wife, intoxicated. A case of alleged murder by hanging, and of considerable difficulty in its medical relations, was tried at the Exeter Summer Assizes, 1851 (*Reg.* v. *Rowe.*) Although the prisoner was acquitted, there were some strong facts leading to the belief that this could not have been an act of suicide.

Some medical jurists have thought that the *mark* left by the cord on the neck would serve as a criterion on which we might depend. Thus it has been said, if the mark be circular, and placed at the lower part of the neck, it is an unequivocal proof of murder. In hanging, the mark of the cord is generally oblique, being higher at the back part of the neck, in consequence of the loop formed by it yielding more in this direction than anteriorly. But it is an error to suppose that this want of obliquity in the impression can afford any evidence in favour of the act having been homicidal. Its form will depend in a great degree upon the fact of the body being supported or not, for it is the weight of the body which causes its obliquity: it will also depend on the manner in which the cord is adjusted. A case of suicidal hanging is related by Orfila, in which the mark of the cord extended horizontally round the neck from behind forwards. (Méd. Lég. tome ii. p. 376.) The slip-knot of the cord was in front of the neck, and it is obvious that when the cord is thus adjusted by a suicide, there will be scarcely any obliquity in the depression produced by it. Equally ill-founded is the assertion, that the existence of *two impressions* on the neck affords positive proof of homicide. One of these impressions may be at the lower part of the neck, and circular; the other at the upper part, and oblique: it is there-

fore contended that the deceased must have been strangled in the first instance, and afterwards hanged. The possibility of a prior attempt being made by a suicide to strangle himself, is not adverted to: "Si l'on observe les deux impressions," says Mahon, "l'assassinat est alors parfaitement prouvé." It is fortunate that there are facts on record to oppose to this very decided statement. One of the first cases reported by Esquirol is that of a female lunatic, who committed suicide by hanging herself, and on whose neck two distinct impressions were seen—the one circular, the other oblique! These appear to have arisen from the cord having been passed twice round the neck, the body being at the same time partially supported. In some instances, a presumption of homicidal interference may exist if there be two distinct impressions, but it cannot be admitted that they establish the fact of murder.

The injury done to the neck by the cord can rarely afford any clue to the manner in which hanging took place, unless the circumstances under which the body is found favour the presumption of homicide or suicide. Thus the laceration of the muscles and vessels of the neck, the rupture of the trachea and the displacement of the larynx, stretching of the vertebral ligaments, and effusion on the spinal sheath, may be observed in suicidal as in homicidal hanging. The presumption, however, is obviously in favour of the latter when these violent injuries are found to be accompanied by fracture or displacement of the cervical vertebræ, and the body of the deceased is not corpulent,—the ligature by which he is suspended is not of a nature to produce them, and the fall of the body has not been great.

Injury to the cervical vertebræ.—A much disputed question has arisen in medical jurisprudence, whether the cervical vertebræ can become fractured or displaced in *suicidal* hanging. Most medical jurists deny the possibility of this accident occurring,—the displacement or fracture of these vertebræ being rarely observed, even in criminal executions, where the greatest violence has been often used by the executioner. So far as I am aware, there is no case of *suicide* on record in which this injury to the neck existed. The case referred to by Petit, which was left to the decision of Dr. Pfeffer, is unsatisfactory, because the body was not examined; and it is doubtful whether the act had really been one of suicide or not. M. Ansiaux, of Liége, in inspecting the body of a woman who had hung herself, found extravasated blood behind the first two cervical vertebræ, which were more widely separated posteriorly than usual. On removing the vertebræ, the posterior ligament of the spine was found ruptured, and the transverse ligament of the atlas so stretched that the odontoid process of the second vertebra was completely locked against the articular surface. The perpendicular and oblique ligaments were entire. The deceased was a stout healthy person: when discovered, her body was suspended from a beam at the distance of about a foot and a half from the floor. She had evidently fallen with considerable force. The case of this female will serve to show that severe injury to these deep-seated regions of the neck may be occasionally met with in suicidal hanging. A case somewhat similar to this has been reported by Mr. Campbell de Morgan. (Lancet, August 10, 1844.) A married woman, aged fifty, worn out and exhausted by disease, was found hanging quite lifeless from the rail of a bed, which was not more than five feet eight inches from the ground. The front of her body was turned round towards the bed, the head thrown forcibly back,—the knot of the ligature, an old silk handkerchief, being placed in the middle of the under side of the chin. Her heels were about three inches from the ground,—the knees being on a level with the bed-frame, and resting against it. The body was seen by a medical man about an hour after it was cut down,—the features were perfectly calm, and there was no trace of congestion about the face: it was pale, and in all respects natural. There was no lividity; the eyes were neither injected nor prominent; the tongue pale, lying far back in the mouth, and without any mark of indentation. The cord-mark well defined, and, like parchment, dry,

brown, and hard, without any ecchymosis, but with a thin line of congestion at the upper edge of the groove:—it was very deep at the back of the neck, just over the atlas, probably owing to the head hanging backwards. The mucous membrane of the stomach was pale; the lungs natural; no congestion of the large veins or of the cavities of the heart: the two ventricles contained about an equal quantity of blood. These appearances seemed to show that death was not caused either by asphyxia or by cerebral congestion. Neither the trachea nor the great vessels of the neck could have sustained any pressure or constriction. The deep muscles over the second and third cervical vertebræ were ecchymosed: this ecchymosis extended to the sheath of the spinal marrow; and on the left side, and exterior to the sheath, there was an extensive effusion of blood firmly coagulated. There was no displacement of the second or other vertebræ, and the ligaments were sound; but between the third and fourth vertebræ, there was unusual mobility as if they had been stretched. In this case the body was not heavy, and the fall, if any, could have been but trifling. The effusion on the spinal marrow was the cause of death; and its origin was sufficiently explained by the falling back of the head and sudden bending of the cervical vertebræ. Her husband and family were *in an adjoining room, but heard no noise;* it was only by accident that the deceased was discovered.

In all doubtful instances, we should not lose sight of moral and circumstantial evidence. We should ascertain whether the individual had been previously disposed to commit suicide or not;—we should observe whether the doors and windows of the apartments be secured on the inside or on the outside;—whether the dress of the deceased be at all torn or discomposed, or his hair dishevelled;—whether the rope or ligature correspond to the impression seen around his neck;—and lastly, whether the ligature be of sufficient strength to support the weight of the deceased. (Case of *Pinckard*, post, p. 516.) These points fall, it is true, more within the province of the officers of justice than of a medical practitioner; but the latter is generally the first who is called to see the deceased, and therefore, unless such facts were noticed by him on his visit, they might often remain altogether unknown.

The position of the body.—Lastly, it has been contended that the *position* of the body may serve to distinguish suicidal from homicidal hanging. This point was strenuously argued on the investigation which took place relative to the death of the *Prince de Condé* in 1830. According to the opinions of some of the witnesses on that investigation, if the body of a man be found in an inclined posture or so suspended that his feet are in contact with the floor, the idea of suicide by hanging is at once negatived,—we are rather to suppose that the person must have been otherwise destroyed, and his body afterwards placed in that position by his murderers. Here, then, we are called upon to admit that suicidal hanging is improbable, if not impossible, unless the body of the deceased be found freely and absolutely suspended without any support! This very strong opinion, it will be seen, is not borne out by facts. In order that death should take place by hanging, it is not necessary that the body should be freely and perfectly suspended. Cases are of very frequent occurrence, where the bodies of hanged persons are found with the feet on the ground, kneeling, sitting, or even in the recumbent posture. These are truly mixed cases of hanging and strangulation. I have now before me the reports of eleven cases of suicidal hanging or strangulation which have occurred within the last few years. In three the deceased were found nearly recumbent; in four, in a kneeling posture,—the body being more or less supported by the legs; and in four, the persons were found sitting. (For many singular cases of this kind, with plates, see Annales d'Hyg. 1830, i. 166; 1831, p. 157; 1834, i. 472.) In one instance, the deceased was found on his knees at the foot of the bed, with his cravat round his neck,—the other end being thrown over the bed-rail, and then twisted tightly round his right hand. In another, the deceased, a prisoner, was found dead in

the sitting posture. (Ann. d'Hyg. 1831, i. 196.) He was hanging to the iron bar of the window of his prison, which was so low that he was almost in a *sitting posture*. The ligature which he had employed was a cravat, but (what was more remarkable in the case) the *hands of the deceased were found tied* by another handkerchief. The body was warm when discovered. There was not the least doubt of this having been an act of suicide; yet, as the reporter observes, had the body been found in an unfrequented spot, the discovery of the hands *tied*, if not the position, would have led to a strong suspicion of murder. In the opinion of the reporter, the deceased had contrived to tie his hands together by means of his teeth. (Ann. d'Hyg. 1832, i. 419.) Among the cases collected by Esquirol, is the following. A patient in La Charité was found one morning hanging by a rope which was attached to the head of his bed. He had fastened this by a loop round his neck, but his body was so retained, that when discovered he was on his knees by the side of his bed. There are one or two other similar instances related by the same author, which I shall omit, and describe one that fell within my own knowledge. In 1832, a man was found hanging in his room, with his knees bent forwards, and his feet resting upon the floor. He had evidently been dead for some time, since cadaverous rigidity had already commenced. The manner in which this person had committed suicide was as follows:—he had made a slip-knot with one end of his apron (he was a working mechanic) and having placed his neck in this, he threw the other end of the apron over the top of the door, and shutting the door behind him, he had succeeded in wedging it in firmly. At the same moment he had probably raised himself on tip-toe, and then allowed himself to fall; in this way he died. The weight of his body had apparently sufficed to drag down a part of the apron, for it seemed as if it had been very much stretched. (See also a case by Dr. Albert, Henke, Zeitschrift, 1843, ii. 50.) [We know of a case in which a man hung himself with a drover's whip, and was found dead reclining on the floor, at the foot of a low bedstead, with one end of the long lash around his neck, and the other end attached to the bed-post. See also Am. Journ. Med. Sci., Jan. 1853, from Med. Times and Gaz., for an analogous but still more remarkable case, in which the individual was found lying on his abdomen with his throat pressing on a loop of leather suspended from the bed-post above.—H.]

Remer found that out of one hundred and one cases of suicidal hanging, in fourteen the body was either standing or *kneeling*, and in one instance it was in a *sitting* posture. Dr. Duchesne has recently published an account of fifty-eight cases, in which the suspension of the body was partial,—the feet or trunk being more or less supported. Twenty-six of these cases are new. The reporter comes to the conclusion that *suicide* by hanging is compatible with *any posture* of the body, even when resting upon the two feet. (Ann. d'Hyg., Oct. 1845, ii. 141 and 346.) Further evidence need not be adduced to show how unfounded is that opinion, which would attach the idea of homicidal interference to cases where a body is loosely suspended, or where the feet are in contact with any support. We ought rather to consider these facts as removing all suspicion of homicide; for there are probably few murderers who would suspend their victims, either living or dead, without taking care that the suspension was complete. Besides, the facts of many of these cases are readily explicable:—thus, if the ligature be formed of yielding materials or it be loosely attached, it will give way to the weight of the body after death, and allow the feet to touch the floor, which they might not have done in the first instance. If there be reason to believe that the body has not altered its position after suspension, we must remember the facility with which insensibility comes on, and the rapidity with which death commonly ensues in this form of asphyxia. (See Med. Gaz., vol. xliv., p. 85.)

The limbs secured in suicidal hanging.—One or two other points are also worthy of notice in relation to this question. The hands or the legs, but more commonly the former, have been frequently found tied in cases of undoubted

suicidal hanging (Ann. d'Hyg. 1832, i. 419;) and yet it has been gravely debated, whether it were possible for a person to tie or bind up his hands and afterwards hang himself! It is unnecessary to examine the ingenious arguments which have been urged against the possibility of an act of this kind having been performed; since among many cases that might be quoted, two occurred in 1841, in this metropolis, where the persons died from hanging: the act was suicidal, and the hands were found tied in both instances with a silk handkerchief. A third case occurred at Worcester in December, 1844, in which the deceased had his wrists with a silk handkerchief, and secured to this two flat irons in order to increase the weight. A remarkable case of suicide in which the hands and ankles were tightly secured has been communicated to the Medical Gazette by Mr. J. H. Taylor, vol. xlv. p. 388; see also cases in Guy's Hospital Reports, Oct. 1851.

Power of self-suspension.—It has been a debated question, whether *corporeal infirmity*, or some peculiarity affecting the hands, might not interfere with the power of an individual to suspend himself. This question can be decided only by reference to the special circumstances of the case. In the case of the *Duc de Condé*, it was alleged that he could not have hanged himself, in consequence of a defect in the power of one hand:—it was said that he could not have tied the knots in which the cravats by which he was suspended were tied. Assertions of this kind appear to have been too hastily made in this and other instances. A determined purpose will often make up for a great degree of corporeal infirmity; and unless we make full allowance for this in suicide, we shall always be exposed to error in drawing our conclusions.

Is blindness a bar to suicidal hanging?—The answer to this question is decidedly in the negative, not from theory, but from actual facts; although one might be inclined to doubt whether a man labouring under such an infirmity could really thus destroy himself. In February, 1837, an inquest was held in London, on the body of a blind man, who was found dead hanging in a coach-house. The evidence left not the smallest doubt of his having committed suicide. Connected with this, is the question how far weakness or infirmity from age may interfere with this form of suicide. Suicide under any circumstances among young subjects is rare. Out of one hundred and ninety-eight suicides, observed by M. Esquirol, at the Salpétrière, there were but two instances of subjects under fifteen years of age. (Ann. d'Hyg. 1836, ii. 400.) The youngest subject at which I have met with a case of suicidal hanging was in a boy of nine years, who hanged himself at Hampstead, in April, 1837. The greatest age was in the case of a man of ninety-seven, which occurred in September, 1842. In a former part of this chapter, it has been stated that asphyxia in hanging may be very insidiously induced, so that although the individual may have the power of easily rescuing himself, yet this is impossible. The transition from life to death in such a case is as rapid as it is imperceptible. This will explain why persons so readily die from slight constriction of the trachea, when their bodies are partly supported, either standing, kneeling, or sitting:—why, also, it is not necessary that the cord or ligature should be drawn tightly round the neck; and lastly, why, as it has frequently happened, this form of suicide should be easily perpetrated by persons labouring under disease or infirmity in a room where others are present or near, but who are not aware of the act. This last circumstance has in more than one instance given rise to an ill-founded suspicion of murder. When an individual has obviously died by hanging, and the presumption of suicide is rebutted, or the act itself denied by a medical witness, the only alternative is, that it must amount to murder. It is not possible to conceive that the act of hanging another can ever admit of justification or excuse. When, as in the case of death from drowning or wounds, it is doubtful whether the act should be referred to suicide or homicide, the admission of its having been homicidal does not necessarily cut off all hope from the accused. The deceased may have

been drowned or wounded accidentally, or he may have been drowned or wounded intentionally; but under circumstances of great provocation. The act, therefore, may turn out to be a form of manslaughter. In hanging, however, the defence could never be that the act was accidental, nor is it possible to believe that the law would admit provocation as a justification for what must have been so deliberately done. The act itself, like poisoning, would be at once evidence of malice. With this knowledge, then, of what the absolute denial of suicide must lead to in a suspected case, a witness is bound to examine closely every medical presumption which can be construed in the least degree unfavourably to an accused party. One of the most remarkable cases on record is that of the *Prince de Condé*, which occurred in 1830, and excited the attention of the medical jurists of France and England. It involves many of the questions connected with the medical jurisprudence of hanging. (For a full account of this singular case, which in my opinion was one of suicide, I must refer the reader to the Ann. d'Hyg. 1831, p. 157.)

STRANGULATION.

CHAPTER LIX.

CAUSE OF DEATH—POST-MORTEM APPEARANCES—WAS DEATH CAUSED BY STRANGULATION?—WAS THE CONSTRICTION APPLIED TO THE NECK AFTER DEATH?—CASPER'S EXPERIENCE ON POST-MORTEM STRANGULATION—MARKS OF VIOLENCE—ACCIDENTAL, HOMICIDAL, AND SUICIDAL STRANGULATION—CASES.

Strangulation. Cause of death.—Hanging and strangulation are usually treated together; and some medical jurists have admitted no distinction in the meaning of these terms. In hanging, the phenomena of asphyxia take place in consequence of the *suspension* of the body, while in strangulation, asphyxia may be induced not only by the *constriction* produced by a ligature round the neck independently of suspension, but by the simple application of *pressure* through the fingers or otherwise to the trachea. It may, indeed, be said, that every individual who is hanged is literally strangled; but hanging is only one form of strangulation, and sufficiently peculiar to claim a separate consideration. We have now, therefore, to direct our attention to the other means which have been employed to obstruct the respiratory process by external pressure on the trachea. These have commonly been arranged and treated under the head of manual strangulation. The *cause* of death is the same in the two cases, namely asphyxia, and the rapidity with which death ensues in strangulation will depend in a great degree on the force employed, and on the completeness with which the respiratory process is obstructed. In strangling, a much greater degree of violence is commonly employed than is necessary to cause asphyxia; and hence the marks produced on the skin of the neck will be, generally speaking, much more evident than in hanging, where the mere weight of the body is the medium by which the trachea is compressed.

Post-mortem appearances.—The post-mortem appearances externally and internally are the same in strangulation as in hanging, but the injury done to the parts about the neck is commonly greater in the former case than in the latter. If much force has been used in producing the constriction, the trachea, with the muscles and vessels in the fore part of the neck, may be found cut or lacerated, and the cervical vertebræ may be fractured. The face is more commonly livid and swollen, the eyes congested, and the pupils are dilated. The mark of the ligature, if a ligature has been used, is generally circular, and situated in the lower part of the neck. Instances have, however, been related where a circular mark has been observed in hanging; and it is possible that some degree of obliquity may occasionally exist in the course of the depression produced by a ligature in strangulation. The medical jurist ought, therefore, to weigh all the circumstances connected with the position of the body, and the direction of the ligature, before he forms an opinion whether the individual has been hanged or strangled. Much more importance is to be attached to the lividity, ecchymosis, and abrasion of the skin in the course of the ligature, than to the circularity or obliquity of the depression produced by it. In the strangling of a living per-

by a cord, it is scarcely possible that a murderer could avoid producing on the neck marks of violent injury; and in the existence of these, we have evidence of the manner in which death has taken place, which we cannot always expect to find in hanging. On the other hand, a person may be strangled, and yet the ligature, in consequence of its being soft and of a yielding nature, will not cause a very perceptible depression or ecchymosis. Such instances must, of course, be rare; because murderers usually produce a much more violent constriction of the neck than is necessary to ensure the death of their victims. The general lividity of the body, contraction of the fingers, with clenching of the hands, and swelling or protrusion of the tongue, are the same in strangulation as in hanging. Mucous froth may also be found in both cases. The *internal* appearances are those of asphyxia. The lungs and right cavities of the heart are distended with thick black blood, while the left cavities are commonly empty. The state of the brain calls for no particular notice. The bloodvessels are sometimes found distended. In some instances of strangulation, it is said that blood has escaped from the ears during the act; but, with a probable exception, to be hereafter mentioned, I am not aware that there is any well-authenticated instance in which effusion of blood was met with on the brain of a strangled subject. (For an account of the appearances in a strangled body thirty-eight days after interment, see Henke, Zeitschrift, 1842, i. 236; ii. 310.)

The medico-legal questions relative to strangulation are of the same nature as those which have been already discussed in treating of hanging. Thus, in examining the body of a person suspected to have been strangled, we may be required to answer the following question:—

Was death caused by strangulation, or *was the constricting force applied to the neck after death?*—The *internal* appearances of the body will yield no evidence whereby this question can be solved; but the *external* appearances are commonly less ambiguous than in a corresponding case of hanging. The ecchymosis about the depression on the neck, when a ligature has been employed, with the accompanying turgescence and lividity of the face, are phenomena not likely to be simulated in a dead body by the application of any degree of violence. When the constriction is produced within a few minutes after dissolution, an ecchymosed depression may result; but it is improbable that there should be any lividity or turgescence of the countenance.

The experiments of Prof. Casper, referred to in treating of the subject of hanging, bear directly upon the question which we are now discussing. He determined, from his observations, that when the constricting force was not applied to the neck until *six hours* after death, the mark indicative of vital strangulation could not be produced. The following is a summary of his experiments on strangulation in the dead body:—

1. *Six hours* after death, a double cord was tightly drawn around the neck of a female, below the larynx. On the following morning the cord was loosened, and the neck examined. There was no particular appearance. When the skin had assumed its natural position, the part where the cord had been placed was scarcely distinguishable.—2. A man died of apoplexy, and *thirteen hours* after death a cord was as tightly drawn around the neck, above the larynx, as possible. Six hours afterwards, on examining the neck, a soft impression, easily removed by pressure, was perceptible. There was no discoloration, nor any other change to be discovered in the skin.—3. *Twenty-four hours* after death, a double cord was very tightly drawn around the neck of a male subject. On examination the next day, there was a slight double depression, but no colour nor any other perceptible change. This experiment was repeated on another subject, with similar results.—4. The last experiment was on the body of a child, about one year and a half old. On the day after death, a small cord was tightly drawn and secured around the neck. Twenty-four hours afterwards, a slight bluish-coloured mark was perceived. It was quite superficial, but sufficiently distinct

to strike the eye. On cutting into the skin there was not any blood effused beneath.

We learn from these experiments that when the attempt to simulate strangulation in a dead subject is not made until *six hours* at least have elapsed, there is no risk of confounding the mark thus produced with that which is formed when the violence is applied to a living individual. It is probable, that so far as the ecchymosis is concerned, if the attempt were made after an hour or two hours had elapsed, it would wholly fail; and with regard to the *non-ecchymosed* mark, it is very doubtful whether it could be produced after three or four hours. These periods, it must be remembered, are not settled with positive certainty: the results would probably vary, according to the degree of rapidity with which the body had cooled.

It is difficult to conceive under what circumstances an attempt to simulate strangulation in a recently dead body could be made, unless for the purpose of throwing suspicion upon an innocent person connected with the deceased. When an individual has been murdered, it is not likely that the murderer would attempt to produce the appearances of strangulation on the body after death, under the idea of concealing his crime; for strangulation is in most cases a positive result of homicide, and is very rarely seen as an act of suicide. In the absence of ecchymosis from the neck, it will be difficult to form an opinion, unless from circumstantial evidence. It must be remembered, however, that there may not always be an ecchymosed *circle*, for an individual may be strangled by the application of pressure to the trachea through the medium of the fingers, or of any hard or resisting material. The ecchymosis in such a case will be in detached spots. In the absence of all marks of violence about the neck, we should be cautious in giving an opinion which may affect the life of an accused party; for it is not probable that homicidal strangulation could be accomplished without the production of some appearances of violence about the larnyx or trachea. It is doubtful whether strangulation ever takes place without some mark being found on the neck indicative of the means used. The bare possibility of death being caused in this manner without leaving any appreciable trace of violence, must be admitted, although the admission scarcely applies to those cases which require medico-legal investigation. Suicides and murderers generally employ more violence than is necessary for the purpose of destruction; hence detection is easy. But if a very soft and elastic band were applied to the neck with regulated force, it is possible that an individual might die strangled, without any external sign being discovered to indicate the manner of his death. Indian surgeons inform us that the Thugs, and other robbers of the Himalaya mountains, are thus accustomed to destroy their victims, with the dexterity of practised murderers. A case involving this question of strangulation without marks of violence, was recently tried in France, and from the medical evidence decided in the affirmative. (Gaz. Méd. 9 Mai, 1846, 375.) The medical witness should, however, be prepared to consider whether, in the absence of any mark, death might not have proceeded from another cause, and leave it to the authorities of the law to decide from circumstances in favour of, or against the prisoner. There is, I conceive, nothing to justify a medical witness in stating that death has proceeded from strangulation, if there should be no appearance of lividity, ecchymosis, or other violence about the neck or face of the deceased. The state of the countenance alone will scarcely warrant the expression of an opinion; for there are many kinds of death in which the features may become livid and distorted from causes totally unconnected with the application of external violence to the throat. Let not a witness, then, lend himself as an instrument in the hands of a counsel, for the condemnation of a person against whom nothing but a strong suspicion from circumstances may be raised, and where medical evidence is unable to throw any light upon the probability of death having resulted from strangulation. (See the trial of *Mrs. Byrne*, for murder,

Dublin Commission Court, Aug. 1842.) This trial is full of interest to the medical jurist. Some post-mortem changes appear in this case to have been mistaken for marks of strangulation.

Marks of violence.—It is scarcely necessary to state that all marks of violence on the body of a supposed strangled person should be accurately noted, as the questions respecting them are material. The witness will be expected to state whether they were inflicted before or after death; if before, whether they were sufficient to account for death, or whether they were such as to be explicable on the supposition of an accidental, suicidal, or homicidal origin. It should be observed whether there exist any morbid changes, sufficient to account for death, in either of the three great cavities of the body, as this kind of evidence may be very essential in the progress of the case.

Was the strangulation the result of accident, suicide, or homicide?—Strangulation, like hanging, is occasionally the result of *accident;* but the occurrence may be looked upon as rare. When the body is not suspended, it is commonly more in the power of an individual to assist himself, and escape from the constriction: hence accidental strangulation is perhaps less frequent than accidental hanging. A few instances of accidental strangulation are on record. One is reported by the late Dr. Gordon Smith. The subject was a boy, who was accustomed to move about with a heavy weight suspended by a string around his neck. One day he was found dead in a chair. The weight appeared to have slipped, and to have drawn the cord tightly round the fore part of his neck. In June, 1839, a girl was accidentally strangled in the following way:—She was employed in carrying fish in a basket at her back, supported by a leathern strap passing round the fore part of her neck, above her shoulders in front. She was found dead, sitting on a stone wall; the basket had slipped off, probably while she was resting, and had thus raised the strap, which firmly compressed the trachea. A similar case is recorded by Watson (Homicide.) There will be no difficulty in deciding a question of accidental strangulation, from the sight of the body and the means of constriction. Should it happen, however, as it is not unlikely, that the body has been removed from the position in which it was first discovered, we can only establish a presumption of accident from the description given by those who first discovered it.

When a charge of murder is instituted against a party, an attempt is not unfrequently made by counsel for the defence to show the probability that the deceased might have fallen while in a state of intoxication, and have become accidentally strangled by a tight cravat, or by some foreign body exerting pressure on the trachea. If we admit the possibility of an occurrence of this nature, we must not lose sight of the existence of other more probable modes of death, nor should we allow our judgment to be so swayed as to abandon what is probable for that which is merely possible.

Suicidal strangulation.—This mode of suicide must be regarded as of extremely rare occurrence, and, except under particular circumstances, impossible. The possibility of an individual strangling himself was for a long time denied by medical jurists; for it was presumed that when the force was applied by the hand, all power would be lost so soon as the compression of the trachea commenced. This reasoning, which is physiologically correct, is, however, only applicable to those cases in which the windpipe is voluntarily compressed by the fingers. When an individual, determined on suicide, allows the trachea to become compressed by leaning with the whole weight of his body on a ligature passed round his neck and attached to a fixed point, he may perish in this way almost as readily as if he had hanged himself; for insensibility and death will soon supervene. In the chapter on Hanging, it was stated that suicides were often found with their bodies in close contact with the ground; and cases were referred to in which strangulation was accomplished in the manner above described, while the suicide was in a sitting or kneeling posture. On other occasions, the peculiar

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disposition or nature of the ligature has enabled a person bent on suicide to strangle himself without much difficulty. An instance is related by Orfila, where two cravats, which were twisted several times round the neck of the deceased, who was discovered lying on his bed, had effectually served the purpose of self-destruction. (Méd. Lég. ii. p. 389.) Sometimes strangulation has been suicidally effected by a rough cord passed several times round the neck, and tightened by being pulled with each hand. The number of coils would cause the pressure to be exerted even where the grasp was relaxed by death. (See Guy's Hospital Reports, Oct. 1851.) Other cases are related, in which suicides have succeeded in strangling themselves by tightening the ligature with a stick (see case by Mr. Thorp, Guy's Hospital Reports, Oct., 1851;) or where this was formed of thick and rough materials by simply tying it in a knot. A young female of Montevrin, in the Canton of Lagny, was found one morning, dead in bed, lying on her face, with a woolen garter passed twice around her neck, and secured in front by two simple knots, strongly tied the one on the other. The body was in an incipient state of putrefaction, but still there was a mark corresponding to the ligature. This was shallow, of a slight greenish colour, especially in front, and presented here and there ecchymosed spots; posteriorly the mark was scarcely visible. The face was livid and swollen: a quantity of sanguineous mucus escaped from the mouth and nostrils. The lips were livid; the tongue protruded, and firmly compressed between the teeth: the body presented, over the trunk and limbs, patches of ecchymosis. On cutting into the mark on the neck, there was no extravasation, neither was there any apparent injury to the deep-seated muscles or adjacent parts: the lungs were gorged with blood, but the other viscera of the body presented no particular appearance. The medical examiners gave it as their opinion, that the deceased had died from apoplexy resulting from strangulation. They stated that the head was not examined, and they judged that apoplexy was the cause of death, from the condition of the face. A more important question was, whether the strangulation was suicidal or homicidal. There was some reason to suspect the latter, and indeed a party was pointed out as the probable murderer; but a rigorous medical investigation, relative to the state of the person and clothes, as well as numerous collateral circumstances, satisfactorily established that this was an act of self-destruction. (Ann. d'Hyg. 1829, ii. 440. See also a case by Dr. Simeons, Henke, Zeitschrift, 1843, i. 335.)

Sometimes the appearance of the *mark* on the neck will allow us to establish a slight presumption for or against homicide. In homicidal strangulation, from the unnecessary violence used, we may expect to find the skin much ecchymosed, lacerated, or excoriated, and the deep-seated parts, such as the muscles and vessels, as well as the windpipe itself, more or less bruised, lacerated, or extensively injured. Such violence is not commonly to be expected in *suicidal* strangulation.

Supposing the marks of fingers to exist, the presumption is in favour of homicide; as also in all cases where the cause of strangulation is not at once apparent on the discovery of the body. Suicides are not likely to strangle themselves in any other way than by a ligature applied circularly. If the ligature be still around the neck of the deceased, the position of the knot may throw some light upon the case; if tied in two or three knots at the posterior part of the neck, the presumption is assuredly in favour of homicide. Then, again, the nature of the ligature should be attended to. Suicides generally employ those articles for ligatures which are nearest at hand,—such as cravats, stockings, or garters. Some medical jurists have attempted to limit the varieties of suicidal strangulation; contending, that when a subject is found strangled in any other way than in one of those arbitrarily laid down by them as essential to suicide, it is evidence of murder. The fact is, cases as yet are few, and each new instance of suicidal strangulation presents us with something novel in the means of its accomplishment; a sufficient proof, therefore, that we ought to be very cautious how we decide these questions by hastily preconceived rules.

The way in which the notorious criminal, *Greenacre*, attempted to destroy himself by suicidal strangulation, presented some novelty; and certainly it does not fall within the methods which, according to some medical jurists, suicides ought on these occasions to adopt. When, in March, 1837, he was confined at a Station-House, he was found by the inspector who entered the room lying on the floor, with a handkerchief drawn tightly around his neck by means of a loop, into which he had inserted his foot. When first seen, his face was livid, and he was apparently dead: the handkerchief was cut, and venesection, with other means of resuscitation, were employed with success. The manner in which General Pichegru was found strangled in prison gave rise to a strong suspicion of murder, merely from the singularity of the method adopted. The ligature which he employed was found tightened around his neck by means of a stick, which had been twisted, and then fixed behind one ear. There was no lividity of the face. It was contended that Napoleon had caused the General to be strangled or suffocated, and that the ligature was afterwards applied. The evidence of this having been an act of homicide is very weak; and so far as the medical circumstances extend, there is no reason to doubt that it was an act of suicide. The only obstacle to the admission of this, in the opinion of some jurists, is the employment of a stick for the purpose of tightening the ligature; but there are at least two similar cases on record, in which the suspicion of murder could not be entertained: one of these is referred to by Metzger (op. cit. p. 309.) But there may be disease, such as paralysis, or deformity in one or both of the upper extremities, which may render it impossible for an individual to tie a ligature around his own neck. The only caution here to be guarded against, is that we do not push this doctrine too far. When there is a fixed resolution, many apparent impossibilities may be overcome by a suicide. The following case is, in this respect, interesting:—

A middle-aged woman was brought into the Hôtel-Dieu, March, 1833, labouring under such a degree of mental excitement as almost to amount to insanity. Very soon after her admission she destroyed herself by strangulation. The nurse, in going round the ward, saw her lying at the side of the bed, with her head hanging out. Upon examination, it was found that she was quite dead, and that there was a silk handkerchief around her neck. The handkerchief had been carried twice round the neck, and then tied in front. The eyes and eyelids were strongly reddened and swollen. The mark of the ligature around the neck was deep, ecchymosed, and partially excoriated: the brain, though a little vascular, was healthy. The other viscera presented no appearance calling for notice. (Ann. d'Hyg. 1833, ii. 153.) It is worthy of remark, that in this instance, in which there could be no doubt of suicidal strangulation, the deceased had lost *four fingers of her right hand*, so that that member had been, from a very early period, of but little service to her: nevertheless she contrived to tie the cravat round her neck with great firmness and dexterity. It is easy to conceive, that had her body been found in a suspicious locality, a plausible opinion of homicidal strangulation might have been formed from the maimed condition of her hand. This case, then, will serve to teach us a proper caution in drawing our inferences as to what persons, labouring under any corporeal infirmity, are capable of doing, when they make attempts on their own lives.

Although the cases just related show that suicidal strangulation may be effected under very singular circumstances, yet, in a case of murder by strangulation, it would not be easy to simulate suicide: it would, at any rate, require a great deal of art and premeditated contrivance, on the part of a murderer, so to dispose the body of his victim, or to place it in such a relation to surrounding objects, as to render the suspicion of suicide probable. Thus, if the ligature should be found loose or detached,—if the ecchymosis or depression should not accurately correspond to the points of greatest pressure,—if, moreover, the means of compression were not very evident when the body was first discovered, and

before it had been removed from its situation, there would be very fair grou for presuming that the act was homicidal. In those cases in which the strangu tion has resulted from compression of the windpipe by the fingers, and wh there are fixed ecchymosed marks indicative of direct manual violence, we ha the strongest presumptive evidence of murder; for neither accident nor suic could be urged as affording a satisfactory explanation of their presence.

Homicidal strangulation.—Strangulation occasionally comes before our cou of law as a question of murder; and when a party has been tried upon a charg of this kind, the circumstances have been commonly so clear, as to have rendered the duty of a medical witness one of a very simple nature. Difficulties do, how ever, occasionally arise, as may be seen by reference to the cases of The Queen *Taylor* (York Lent Assizes, 1842,) and The *Queen* v. *Greek* (Salisbury Lent Assizes, 1843.) See also the important case of *Queen* v. *Reynolds* (Central Criminal Court, Dec. 1842.) Here it was left uncertain, by the medical evidence, whether death was due to strangulation, or malicious exposure to cold; and as the indictment only charged the former act, the prisoners were acquitted. So likewise the case of The *Queen* v. *Fowles* (Stafford Lent Assizes, 1841.) For a full report of a case in which the question was, whether the deceased had com mitted suicide by hanging, or had been strangled by her husband, I must refer the reader to Cormack's Journal for 1844, p. 344. The prisoner was acquitted on a verdict of "Not proven." An interesting case of alleged murder by strangulation (*Commonwealth* v. *Flanagan*,) is reported in the American Journ. of Med. Sciences, Oct. 1845, p. 339. See also the case of *Rex.* v. *Drory*, Guy's Hosp. Reports, Oct. 1851.

Cases.—The following case, reported in the Annales d'Hyg. (1829, ii. 45), presents several points of interest in relation to this form of death. It was pronounced to be a case of *suicidal* strangulation by some, and of *homicidal* by others. A servant girl, far advanced in pregnancy, was found dead in her bed. According to the report of the surgeon who first saw her, the body was rigid, and there was a handkerchief so firmly tied around the neck, that it was with some difficulty removed. A quantity of air and sanguineous mucus escaped from the mouth and nostrils on its removal. The body of the deceased, when first seen, was lying in a constrained position with the face turned to the right. The knot in the handkerchief, which was tied round the neck, was on the *left side*, as it is customary to find it in left-handed people. This remark was particularly made by the surgeon, who happened to be himself left-handed. The deceased was not left-handed; and there was no reason to suspect that she had intended to commit suicide. She went to bed the night before in her usual health and spirits. On examination of the body, no mark of violence was seen externally —but there were large patches of cadaverous ecchymosis scattered over the skin. There was a deep impression of a necklace on the skin of the neck, which had resulted, it was supposed, from the force with which the handkerchief had been tied. The neck appeared swollen, especially on the right side. On opening the cranium, the cerebral vessels were found much distended, especially on the right side; and on this side about half an ounce of blood was found extravasated. From the mouth, the tongue projected forwards between the teeth, but was uninjured by them. The contents of the thorax and abdomen presented nothing unusual —the lungs were gorged with blood, as they are generally found in asphyxia.

The examiners attributed death partly to apoplexy, and partly to interrupted respiration, in consequence of the ligature on the neck. They considered that the strangulation was not suicidal for the following reasons:—

1. The handkerchief was tied in *two knots*, and the deceased could not have made more than one; her senses would have failed her before she could have made a second; or at least before she could have made it so perfect as the first.

2. If she had strangled herself, the knot of the ligature would rather have been on the fore part of the neck, than on the left side.

The position in which the body was found, the cheerful conduct of the deceased on the night before her death, and the absence of all motive to induce her to commit suicide, were facts also dwelt upon by the examiners;—but they are manifestly of less weight than the first two assigned. Strong suspicions fell upon a man with whom the deceased had cohabited. He was arrested and charged with the murder. He gave a very unsatisfactory account of himself, but it was clearly proved that he could not have been at the house of the deceased on the night on which her death took place. It was also shown that he was *not left-handed*. The prisoner upon this evidence was liberated. The master, in whose house the deceased lived as servant, was *left-handed;* but there was no reason to suspect him of the crime. Other witnesses deposed that they saw no one in or near the house on the night of the supposed murder: and in consequence of no other clue being discovered, and all means failing to find out the presumed murderer, it was ordered that the medical facts of the case should be reconsidered.

Many were inclined to suspect that the deceased had destroyed herself, others that she had died a natural death. The College of Brunswick was appealed to by the legal authorities, to express a formal opinion from the medical facts, whether the deceased had been murdered by strangulation, or whether she had died from natural causes. The question of suicide appears to have been wholly abandoned.

The College decided that the deceased could not have died by strangulation; because there was no ecchymosis produced on the neck by the handkerchief. They assigned apoplexy as the probable cause of death, from the extravasation of blood met with in the right hemisphere of the brain. They considered that the girl had herself tied the handkerchief round her neck, for the purpose of keeping herself warm, as the night on which she died was extremely cold. They admitted the probability that she might have imprudently tied the handkerchief too tightly;—a circumstance which had perhaps facilitated the congestion of the cerebral vessels and extravasation of blood.

The opinion expressed by the College was drawn up at a time when it was universally believed that the mark of the cord, in vital strangulation, was *always* accompanied by ecchymosis; and that the non-discovery of this was a sufficient proof of strangulation after death. The error of this opinion has been already sufficiently exposed:—therefore the argument, that the deceased had not died by strangulation, falls to the ground. The reason assigned for the handkerchief being placed around the neck appears wholly inconsistent with the facts. It is scarcely to be imagined that any individual who did not contemplate suicide would retire to rest with a handkerchief tied in a double knot *so tightly* around the neck, as to render it very difficult to remove. It was evidently so tight that strangulation might easily have resulted from the constriction. The apoplectic appearances in the head may really have been due to the impeded circulation of the blood, in consequence of the ligature:—at least it is as easy to conceive this, as to admit that they should have coincidently arisen from spontaneous causes. There was, therefore, nothing to contradict the opinion of death from strangulation:—no morbid cause capable of giving rise to sudden death (excepting cerebral extravasation, which has already been accounted for) was discovered in the body. Whether the ligature was placed round her neck by the female herself, or by a murderer, is a matter of doubt:—yet when we consider that there was nothing absolutely impossible in the act on her part,—that there were no appearances of violence about her person or clothes,—and no evidence of any individual having had access to the apartment,—it appears most probable that the strangulation was *suicidal*.

Since the former edition of this work was published, several important cases of murder by strangulation have been brought to trial. In two of these, I was required to investigate the circumstances, and give evidence respecting the mode in which death took place, and the medical reasons which led to the inference

that the deceased persons could not have died by their own hands. For a full report of one of these cases (*Reg.* v. *Drory*, Essex Lent Assizes, 1851,) I must refer the reader to Guy's Hosp. Rep. Oct. 1851. The deceased in this case was found strangled, with a rope coiled three times round her neck, the two inner coils being tight and the outer coil loose, the end of the cord being placed loosely near the left hand of the deceased, which was raised towards it. The length of the free portion of cord was not sufficient to allow of the deceased grasping it and tightening it to such a degree as to produce the great amount of violence found on the neck. This, with other facts, tended to prove that the act must have been one of murder. In another case (*Reg.* v. *Pinckard*, Northampton Lent Assizes, 1852,) it was proved that deceased was found sitting in a corner of her room, with a narrow tape round her neck, hung loosely and singly over a small brass hook about three feet above her head. Her clothes were placed smoothly under her, and her hands stretched out by her side. There was a severe bruise on the right eye, and there were marks of blood on the tape, as well as on the floor and wall of the room at a distance from the body. There was a stain of blood on the knot of the tape where it passed over the hook; and there was no blood on the hands of the deceased. The windpipe for about an inch and a half was lacerated *longitudinally* in its rings, and there was a deep mark round the neck in the course of the doubled tape, as if from great pressure applied by some person, or from the weight of the suspended body. The latter hypothesis was untenable. The body of the deceased did not weigh less than 126 pounds, while the tape found round her neck broke with a weight of 49 pounds: hence the deceased never could have been suspended by it. This fact, with the smooth arrangement of the clothes, the severe marks of violence on the body (inexplicable on the hypothesis of suicide,) and the marks of blood and struggling in the room, proved that there had been homicidal interference; and the crime was brought home to the prisoner by a series of moral and circumstantial proofs. Both of these criminals confessed their crimes before execution.

The reader will find the report of an interesting case of alleged death from homicidal strangulation in the Med. Gaz. vol. xli. p. 295; see also vol. xliv. p. 1084.

But it may be inquired whether *marks* of violence on the body, or blood-stains on the clothes or furniture, do not afford strong evidence of *homicidal* strangulation. The answer is—if the marks of violence be such that they could not possibly have arisen from any accident before death, or that they could not possibly have been self-inflicted, they afford the strongest evidence of murder. But the cases wherein so positive an answer may be returned, are the exceptions to the rule. It is not always in our power to distinguish *accidental* or *self-inflicted*, from homicidal violence; and we are always bound to look to the possibility of accident, or of previous attempts at suicide, being the source of those personal injuries which may be apparent on a strangled subject.

In the following case, communicated to me by Dr. Campbell, of Lisburn, the marks of injury to the neck clearly established homicidal strangulation. The dead body of an old man, aged 70 years, was found lying in a potato-field adjoining his house, on the 10th of October, 1842. His family consisted of a son, the son's wife, and a male servant, brother to the son's wife. The deceased had gone to gather potatoes for the servant who was digging. On its being known to their neighbours that the body had been found in the field, suspicions were excited that his death had resulted from violence. An inspection of the body was ordered. The depending parts were very livid, owing to their position. On opening the skull, a large quantity of dark fluid blood escaped: the membranes of the brain were greatly injected, the sinuses gorged with blood, and the brain itself was highly vascular. Several clots of blood were observed in the lateral ventricles, and some over the surface of the brain. In the chest the lungs were

filled with very dark fluid blood, the air-cells were ruptured, and there was considerable emphysema. The right side of the heart was greatly distended with dark blood: there was nothing remarkable in the abdominal viscera, but the lining membrane of the stomach was congested. The stomach was about half filled with potatoes. On the neck, over the left wing of the thyroid cartilage, there was a very slight mark of a crescentic form, with a corresponding, though slighter mark on the opposite side; and on removing the skin over those marks a considerable amount of coagulated blood was seen immediately beneath, and in the substance of the muscles. On removing this, the left wing of the cartilage, which was ossified, was found much depressed, and traversed by a fracture nearly an inch in length. From the general appearances presented by the body, together with the injury to the thyroid cartilage, an opinion was given that death had arisen from manual strangulation, and from the particular form of the external marks over the neck,—*by a left hand.* Several witnesses were examined, who proved that the deceased and the servant were on bad terms, the deceased having threatened to dismiss the servant, and that before they had gone to dig the potatoes, the servant said he would be revenged of his master. The servant was committed for trial at the ensuing assizes. One of the magistrates present desired that the prisoner might be requested to throw a stone, in order to ascertain if he was left-handed, which he did with the *left hand.* At the trial, the sister of the prisoner swore that she saw her brother strangling the old man; and several witnesses proved that he had maltreated the deceased on many previous occasions. The counsel for the defence advocated the prisoner's case so well, and proved the sister to be of so improper a character, that the jury, having some doubt as to her veracity, acquitted him. Dr. Campbell forwarded to me the larynx, which was ossified, and fractured in the ossified portion, as described in the report of the case.

There may be *several marks* on the neck; but then the individual may have tried to strangle himself more than once. The throat may be cut, or there may be a deep-seated stab or gun-shot wound, involving some of the important organs of the body:—but in a purely medical point of view, how are we to know that the deceased did not actually inflict those wounds upon himself? In the chapters on Drowning and Hanging, we have seen what suicides can do, when they are desperately bent on destroying themselves. These injuries often create the most serious difficulties to the medical jurist, which it requires the greatest caution and prudence on his part to steer through. The prejudice of the public mind is such, that the discovery of a strangled person, with marks of personal injury or of poisoning in his stomach, would, in most cases, lead to a declaration of murder, unless the facts rendered it clearly impossible that any attempt could have been made on his life. It is against this prejudice that the medical witness must strenuously guard himself:—he may be abused for not joining in the outcry of the vulgar; but the best recompense for this abuse will be the conviction, that he is interposing the shield of science to protect a possibly innocent fellow-creature from the senseless denunciations of ignorance.

It cannot be disputed that in contested questions of suicidal or homicidal strangulation, rare as they are, we must be very often greatly indebted to evidence founded on circumstances, as well as to moral presumptions. How far a medical jurist may be allowed to make use of these in the formation of an opinion, it will be for the Court to determine. Generally speaking, his duty is rigorously confined to the furnishing of medical evidence from medical data alone; but instances present themselves in which this rule must be departed from, or the course of justice will be impeded. Besides, there are numerous circumstances of a collateral nature which may materially modify a medical opinion. Thus, the sight of the ligature, the state of the dress, and the attitude of the deceased when discovered, although not strictly medical circumstances, bear directly upon

them; and that evidence ought not to be objected to which is partly founded upon facts of this nature.

It must occur to all, that without circumstantial evidence the best medical opinion in these cases will often amount to nothing. It may be, for example, no more than this: the case is either one of homicide or suicide; and why is such an indefinite answer to be returned? Because, in the abstract view of strangulation, it is not easy to determine whether a ligature was *suicidally* applied round the neck or not. The appearances may be in many cases the same; and where they are different, this difference may be due to accident; so that it is a mistake to suppose that we must look to medical circumstances *alone* for clearing up this intricate question.

There is, perhaps, one instance which may justify a presumption of homicide. A man, in strangling himself, is not likely to vary the means: it is commonly due to a sudden impulse, if we may judge from the moral proofs afforded in the instances on record. The article which is nearest to the suicide is seized, and made the instrument of destruction. It has already been stated as doubtful whether a person could strangle himself by the mere application of the fingers to the trachea; the discovery of such *marks only* as would indicate this kind of strangulation, therefore, renders suicide in the highest degree improbable. But if, besides these marks of fingers, we find a circular mark, with the ligature still around the neck, the presumption of murder becomes, indeed, strong. It may be said, that an individual might at first try to strangle himself with his fingers, and, not succeeding, might afterwards employ a cord. But the degree to which the coincidental impressions exist will assuredly in general remove this objection. A murder was committed some years since in this country in the manner here stated. A gentleman of fortune was found strangled on board of a ship in the port of Bristol. Besides the mark of a rope drawn tightly round the neck, there were distinct impressions of nails and fingers in front of the throat. An investigation took place, and the result proved, as, indeed, this state of the neck rendered it almost certain, that the deceased had been murdered. It was afterwards confessed by one of the murderers, that they had first strangled him with their hands, and then drew the rope about his neck, to insure the certainty of his death.

In concluding this account of strangulation, it may be remarked, that attempts are sometimes made to attribute traces of violence on the neck to accidental causes, notwithstanding the almost entire certainty of their being homicidal. Thus, when a man is found dead with a mark on the neck, it will be argued that the deceased might have fallen while in a state of intoxication, and have become strangled by his cravat, his head being at the same time bent forwards. The witness will be asked whether death was not possible under such circumstances. In returning an answer, he should take care to let it be understood, that what is physically possible is not always medically probable.

The marks of strangulation on the throat may be sometimes ascribed to the deceased having fallen with his hand possibly applied to his neck, and the inference will be drawn that they have accidentally resulted from the pressure of his own fingers; but this is a very improbable mode of accounting for the production of ecchymosis or excoriation of the skin.

SUFFOCATION.

CHAPTER LX.

SUFFOCATION FROM MECHANICAL CAUSES—VARIOUS FORMS OF—CASES—CAUSE OF DEATH—POST-MORTEM APPEARANCES—EVIDENCE OF DEATH BY SUFFOCATION—ACCIDENTAL, SUICIDAL, AND HOMICIDAL SUFFOCATION—MEDICAL AND PHYSICAL EVIDENCE OF THE CAUSE OF DEATH—CASES—SMOTHERING.

Suffocation from mechanical causes.—By suffocation we are to understand that condition in which the air is prevented from penetrating into the lungs, not by constriction of the trachea, but by some mechanical cause operating on the mouth externally, or fauces and larynx internally. In this sense, it will be perceived that drowning is nothing more than death by suffocation.

There are many varieties of death by suffocation, all of which are of great medico-legal interest. 1. The continued pressure of the hand over the mouth and nostrils, or the placing of a plaster or cloth over these parts, combined with pressure on the thorax: this was formerly not an unfrequent form of homicidal suffocation. 2. Smothering, or the covering of the head and face with articles of clothing, &c., which effectually prevent respiration. 3. The accidental or forcible introduction of foreign bodies into the mouth and throat. 4. The plunging of the face into mud, snow, dust, feathers, or similar substances. In all of these cases death takes place from asphyxia, and with great rapidity, if the chest sustains at the same time any degree of forcible compression. 5. Swelling or spasm of the glottis produced by the contact of corrosive substances. A case was referred to me in July, 1848, in which death was probably thus caused by the application of a strong solution of pernitrate of mercury to an ulcer in the fauces.

Suffocation may also arise from morbid causes, such as a diseased state of the parts about the fauces, a morbid enlargement of the thymus gland, the sudden bursting of a tonsillary abscess, or the effusion of lymph, blood, or pus into the windpipe, or about the rima glottidis. Any of these causes may suddenly arrest the respiratory function; a fact which can only be determined by a proper examination of the body. Two cases of death from suffocation produced by mechanical causes have been reported; the one by Dr. Geoghegan, who has communicated to me the particulars, and the other by Dr. Jackson, of Leith. Dr. Geoghegan's case was that of a boy, who died in half an hour under alarming symptoms somewhat resembling those of poisoning, and it appeared that a simple medicinal powder had been given to him about five minutes before the attack! On inspection, the lower part of the trachea was found blocked up with cheesy scrofulous matter:—it was evident that the child had died from asphyxia. Dr. Jackson's case is perhaps one of the most remarkable on record. A man, aged 31, was put to bed drunk, having previously vomited; and shortly afterwards he was found dead. On inspection, Dr. Jackson discovered the usual appearances of asphyxia, *i. e.* congestion of the lungs and of the right cavities of the heart. He was thus led to examine the trachea carefully, and he found, lying over the

rima glottidis, a thin and transparent piece of *potato-skin*, so closely applied to the fissure as to prevent respiration. The man had died suffocated from this mechanical cause. He had had potatoes for dinner the day before; the piece of skin had probably been thrown up at the time of vomiting, and had been drawn back by inspiration into the singular position in which it was found. Owing to intoxication, the deceased was probably unable to cough it up. I agree with Dr. Jackson in thinking that this case conveys a most important caution. In England, the verdict would most probably have been, "Died by the visitation of God," without a post-mortem inspection! The result clearly shows that in every case of sudden death there should be a strict investigation of all parts of the body. (Ed. Med. and Surg. Journ., April, 1844, 390.) I am indebted to Mr. Richardson, of Mortlake, for an interesting case of death from suffocation, caused by the vomiting of the contents of a full stomach, a portion of the food having blocked up the throat. A similar case is reported by Mr. Matthews, Lancet, Aug. 31, 1850, p. 262. Such facts show the absolute necessity of making a careful post-mortem examination in all cases of sudden death. Children are often suffocated from small portions of food penetrating into the air-passages; and unless an inspection be made, death may be easily referred to some natural cause. (See case by Mr. Synnot, Med. Gaz. xl. 994; and also Lancet, May 16, 1846, 561.) In some instances, a retraction of the base of the tongue may lead to the suffocation of a new-born child. (Seller's Journal, March, 1845, 278.)

Cause of death.—It has been already stated that death takes place by asphyxia; and this occurs with a rapidity proportioned to the degree of impediment existing to the passage of the air. There does not seem to be any reason to attribute death to apoplexy. The congestion of the cerebral vessels may be regarded as a consequence of the disturbance of the functions of the lungs. If the veins of the neck were opened so as to prevent an accumulation of blood in the cerebral vessels, it is pretty certain that the prevention of respiration would destroy life under the same circumstances and within the same period of time. Therefore we may regard death from suffocation as resulting from pure asphyxia.

Post-mortem appearances.—There are rarely any considerable marks of violence externally. When the body has become perfectly cold, there may be patches of lividity diffused over the skin; but these are not always present. The lips are livid, but the skin of the face is often pale. The mouth, throat, and parts about the larynx, should be examined for foreign substances. Internally the lungs and right cavities of the heart are distended with blood:—the left cavities either contain but little blood, or are empty. The viscera may here and there present patches of ecchymosis. The cerebral vessels are sometimes congested; but at other times they do not appear more than ordinarily full. All other appearances are of an accidental nature, and are not at all connected with death by suffocation. (See cases by Casper, Med. Gaz. vol. xliv. p. 1084; also a series of papers by Mr. B. W. Richardson, Med. Gaz. xlvii. p. 359, et seq.)

Evidences of death from suffocation.—In medical jurisprudence, there is not, perhaps, an instance in which we have fewer medical data upon which to base an opinion, than in the case of alleged death from suffocation. The inspection of the body of a person suffocated presents so little that is peculiar, that a medical man, unless his suspicions were roused by circumstantial evidence, or by the discovery of foreign substances, would probably pass it over as a case of death without any assignable cause; in other words, from *natural* causes. In examining the body of the woman *Campbell*, who was murdered by *Burke*, in Edinburgh, Dr. Christison was unable to come to a conclusion respecting the cause of death until some light had been thrown on the case by collateral evidence. On this occasion a violent death was suspected because there were marks of violence externally, and the face of the deceased exhibited the characters of strangulation; but these conditions are by no means essential to death from suffocation, and when they exist, they can only be regarded as purely accidental accompaniments.

Appearances similar to those found in the bodies of suffocated persons are very frequently met with in post-mortem inspections when death has taken place as a consequence of disease or accident. They can, therefore, furnish no positive evidence of the kind of death; they do not even permit us to establish a presumption on the subject until, by a careful examination of the body, we have ascertained that there is no other cause of death depending on organic disease or on violence. Medical evidence may, however, be highly serviceable in some instances. Thus, let the general evidence establish that a deceased person has probably been suffocated,—the witness may have it in his power to state that the appearances in the body are not opposed to the supposition of this kind of death; that the body is in all respects healthy and sound; and that the death was probably sudden, as where, for instance, undigested food is discovered in the stomach. In all cases of this description, we must bear in mind that our opinion relative to the supposed cause of death is to be formed from the *medical* circumstances only, unless it be otherwise ordered by the Court. From this want of clear evidence, great difference of opinion on the cause of death will exist among medical witnesses. In the case of *Reg.* v. *Heywood* (Liverpool Summer Ass. 1839,) some of the witnesses referred death to suffocation, others to apoplexy. (Lancet, Sept. 14, 1839, 896.)

Accidental, suicidal, and homicidal suffocation. Suffocation is by no means uncommon as an accident; and there are several varieties of accidents under which a person may die suffocated. 1. Disease about the tongue, larynx, or fauces, may advance to such an extent as effectually to impede respiration. 2. The deceased may have fallen, so that the mouth became covered with dust, or other substances; and if the subject be helpless, as an infant or an aged person, or one who is intoxicated, death may thus easily take place. A child was found dead in a room, with its face in the ashes under the grate. It had fallen during the absence of the mother, and, from its helpless condition, had speedily become suffocated. Some of the ashes were found in the windpipe. (Med. Gaz. xvii. p. 642. For a case in which suffocation was caused by a pea, see the same journal, xxix. 146.) In trials for murder or manslaughter, a medical opinion respecting the possibility of the accidental suffocation of a drunken person, under similar circumstances, is very often required. These subjects, it must be remembered, are generally to be considered as helpless as children:—if they fall in a position so that the mouth be covered, it is possible that they may have been so intoxicated as not to be able to escape. 3. A portion of food may have remained fixed in the larynx or fauces. Children are often accidentally suffocated from drinking boiling water from a tea-kettle. The parts about the larynx then become swollen from the action of the hot water, and respiration is arrested. 4. Accidental suffocation is not uncommon among infants, when they sleep with adult persons. A child may be in this way very speedily destroyed. Even the close wrapping up of a child's head may effectually kill it, without any convulsive struggles to indicate the danger to which it is exposed. These convulsions by no means necessarily attend on death from suffocation.

A few years since, a coroner's inquest was held on the body of a child, which was found dead in a bed; and I assisted a friend in the post-mortem inspection. It was lying in a composed attitude on the bed, with the face nearly covered. There were faint traces of cadaverous lividity about the neck and back; but the body did not present the least mark of violence. The face was pale, but the lips were livid. On examining the chest, the great vessels connected with the heart and lungs were found congested with blood. The vessels of the brain were empty. There were no morbid appearances whatever in any of the other organs. The account given by the girl who attended the child was, that she had laid it to sleep about nine o'clock in the morning, covering over the greater part of its face. She remained in the room; but in the course of an hour, not hearing the child breathe, she looked and found it dead. The only opinion which we were

asked to give, was,—whether, from the circumstances, suffocation was probable? We answered in the affirmative; and a verdict of accidental death was returned. This case shows the ease with which an infant may be destroyed, even when its respiration is only partially impeded. The weight of the clothes may have combined to cause death, by preventing the free expansion of the chest.

Those instances of accidental suffocation which depend on disease or the impaction of food, are easily known by a post-mortem examination:—generally speaking, they present no difficulty. (See case, Med. Gaz. vol. xlii. p. 970; also Lancet, Sept. 2, 1848, p. 259.) But in other cases, *e. g.* when a child or a drunken person is presumed to have been suffocated owing to the position in which he has fallen, evidence as to the position of the body, or even actual sight of the body, is necessary before forming an opinion. The following questions may here arise:—Was the position such as to be explicable on the supposition of accident? Was it not such a position as might have been given to it by a murderer? Could not the deceased have had strength or presence of mind to escape? Could he have been actually suffocated in the position in which his body was discovered? A little reflection upon the circumstances,—for here something more than medical circumstances will be required,—may enable us to give satisfactory answers to these questions.

Suicidal suffocation.—As an act of *suicide*, suffocation is extremely rare. It would require a peculiar adaptation of means, and considerable resolution, in order that a person should thus destroy himself. The following case occurred in France some years since. A woman locked herself in her room with her young child:—she placed herself under the bed clothes, and desired the child to pile the several articles of furniture in the room upon her. When the apartment was entered some hours afterwards, the woman was found dead. She had evidently been suffocated. Had not the child clearly detailed the circumstances, a strong and even justifiable suspicion of murder might have arisen. In the case of a body found with a plaster covering the mouth and nostrils, or the traces of such having been applied, the witness might be asked whether this could have been so placed by the individual himself? No such case has ever occurred as an act of suicide; but we are not, therefore, to say it is impossible; all that we are justified in stating is, that it is a highly improbable mode of self-destruction.

Some singular cases are on record, in which individuals have wilfully destroyed themselves by blocking up the fauces mechanically. A remarkable instance of this form of suicide is reported in the Ed. Med. and Surg. Jour. April, 1842. A woman, confined in prison, forced a hard cotton plug into the back of the fauces. The cavities of the chest and abdomen had been already examined, and a medical certificate given that the deceased had died of apoplexy! The body was sent to one of the anatomical schools, and, on re-inspection, it was then accidentally found that the fauces were firmly blocked up with a plug of spindle-cotton. A similar case was the subject of an inquest in London, in September, 1843. The deceased here had thrust into her throat a large piece of rag, which had been used in applying a lotion. She speedily died suffocated, and after death the rag was found lodged at the back part of the larynx. The internal organs in these cases present no particular appearances indicative of the kind of death. Such cases are very likely to be mistaken for apoplexy, and they certainly show the absolute necessity for a careful post-mortem examination in every instance of sudden death. (See Ed. Med. and Surg. Jour. liv. 149; also, Med. Chir. Rev. xxviii. 410.) The case of *Reg.* v. *Heywood*, Lancaster Sum. Ass. 1839, proves how easily a defence of apoplexy may be sustained in a case of alleged murder by suffocation.

Homicidal suffocation.—Homicide by suffocation is not very common, although it is a very ready means of perpetrating murder. Hitherto, the cases which have come before our courts of law have been those of infants or of aged and infirm persons. In regard to the latter subjects, the rigorous administration of the law

has succeeded in putting a check to this crime: but with respect to children, it probably yet continues. Infanticide by suffocation is most difficult to detect; and, unless the murderer have employed a very unnecessary degree of violence, it is probable that the crime may pass altogether unsuspected.

Homicide by suffocation would not be attempted on healthy adult persons, unless they were in a state of intoxication, and thereby rendered defenceless. It is certain that most individuals would have it in their power, unless greatly incapacitated by disease or intoxication, to offer such a degree of resistance as would leave upon their persons indubitable evidence of murderous violence. Death by suffocation may be considered as presumptive of homicide, unless the facts be clearly referrible to accident. Accidental suffocation is, however, so palpable from the position of the body and other circumstances, that when death is clearly traced to this cause, it is not easy to conceive a case in which it would be difficult to distinguish it from a case of murder. In some instances, the very means which have been adopted to produce it may forbid the supposition of accident, and clearly establish the fact of homicide.

The suffocation of new-born children, by the introduction of substances into the mouth, is not very unfrequent. (See ante, p. 331.) The unnecessary force employed generally leaves traces of violence, which may be easily discovered by a careful examination, even should it happen that the substance employed for the murderous purpose has been removed. M. Devergie has suggested an objection to evidence founded on a fact of this nature, that the substance might have been introduced after death in order to create a suspicion of infanticide against the mother; but such an objection could hardly be received, since the fact is only one out of many which would be brought against an accused person. According to Devergie, the appearances produced by the introduction of a plug of linen into the mouth *during life*, are these:—the mouth contracting posteriorly, the pressure would be greater in this situation, consequently the blood would be forced out of the compressed mucous membrane of the palate. Anteriorly, the pressure would be less; and here the blood would accumulate, so that the mucous membrane in this situation would become swollen and red. In trusting to these characters, it must be remembered that similar appearances would probably result if the plug were introduced immediately *after death*, as, also, that even when introduced during life, the characters might be lost if the plug were removed from the mouth before the body had entirely cooled.

It is necessary to point out a very dangerous practice common among ignorant nurses, which, without exciting suspicion on the part of a coroner or medical witness, may be an occasional cause of death in infants. In order to quiet a child, and to enable the nurse to sleep without disturbance, a bag made of wash-leather or rag, containing sugar, is thrust into the child's mouth. It is thus completely gagged, and the child soon becomes quiet, respiring chiefly through the nostrils. If these by any accident become obstructed, or by the act of respiration the bag should fall to the back of the fauces, death by suffocation must inevitably result,—the infant being perfectly helpless! The suspension of respiration may be so gradual that the child may die without crying or convulsions. The removal of the bag from the mouth will remove every trace of the cause of death; for no pressure is exerted; and in order to exculpate herself, the guilty person may ascribe death to "fits." In one instance, within my knowledge, an infant was timely saved by the mother having discovered, while the nurse was sleeping, a mass of wash-leather projecting from the mouth of the child. The woman awoke, and attempted to remove and conceal it, but was detected. The detection of this abominable practice can only be a matter of pure accident: hence, a fatal case can be rarely the subject of a coroner's inquest, and medical evidence may fail to throw any light upon it. In one instance only have I known it to have given rise to a criminal charge. (*Reg.* v. *Cox*, Warwick Lent Assizes, 1848.) The mother, a pauper female, was tried for the attempt to suffocate her

infant eleven days old. The child was discovered by another person with a piece of rag hanging from its mouth. It was livid in the face, but when the rag was removed made a violent gasp, and recovered its breath. There was no malice on the part of the prisoner, but it was made a strong point in her favour that instances had occurred in the workhouse of women putting rag with sugar on it into the mouths of infants to soothe and keep them quiet! The jury acquitted her. This admitted practice of infantile suffocation in the Warwick workhouse appears to have passed without reprimand or even comment, although this plan of soothing infants is just as likely to be fatal to them as surrounding their necks with a ligature.

SMOTHERING.

Smothering is only a variety of suffocation, and consists in the mere covering of the mouth and nostrils in any way so as to prevent the free ingress and egress of air. Like drowning, hanging, or strangulation, it produces death by asphyxia. In newly born infants it is not an unusual occurrence, sometimes originating in accident, and at others in criminal design. An infant is very speedily destroyed by smothering. If the mouth be only lightly covered over with clothing, or slightly compressed, so that respiration is interrupted, as in the act of carrying a child in the arms, this will suffice to cause death; and, as it has been already remarked, death often takes place without being preceded by convulsions or other striking symptoms. Smothering is not often resorted to as a means of perpetrating murder, except in infants, or in debilitated and infirm adults. Certain trials, which took place some years since, clearly proved that individuals, in a state of intoxication or infirmity, had been murdered by smothering, for the sake of the money derived from the sale of the dead bodies! It will be sufficient to mention the trials of *Burke* and *Macdougall* in Edinburgh, and of *Bishop* and *Williams* in this metropolis, as affording ample evidence of the past existence of this horrible system of secret murder. (See Ed. Med. and Surg. Jour. April, 1829, p. 236.) The victims were commonly destroyed by the murderer resting with his whole weight upon the thorax, so as to prevent the motion of the ribs, and at the same time forcibly compressing the mouth and nostrils by his hands, to prevent the ingress of air. A case of this kind was referred to me for examination in 1831, (*Rex* v. *Elizabeth Ross*, Old Bailey S., Dec. 1831.) It was remarkable for the fact that the prisoner was convicted of homicidal suffocation, although the body of the deceased was never discovered (see Med. Gaz. xxxviii. 481.) In Nov. 1844, a man was convicted at the Assizes of the Seine of the murder of a woman by placing a pitch-plaster over her face. A trial for murder by smothering took place at the Lincoln Lent Assizes, 1843. (The *Queen* v. *Johnson*.) The prisoner, while committing a burglary, tied the deceased to a bed, so that she could not move, and then closely tucked the clothes over her head. After remaining some hours in this condition, the deceased died. The prisoner was convicted and executed. For an important case, involving the question of death from homicidal smothering, or from apoplexy, see The *Queen* v. *Heywood*, Lancaster Summer Ass. 1839. As an accident, smothering may be conceived to take place when an individual falls in a state of intoxication and debility, so that his mouth becomes in any way covered, or the access of air to the mouth or nostrils is interrupted. On an inspection of the body, the appearances described under the head of asphyxia will be met with in the organs of circulation and respiration: hence in a suspected case of murder, we must look for the common indications of asphyxia, and to the circumstances under which the body is found, before we can offer an opinion on the probable cause of death. (For some facts connected with this subject, see Ann. d'Hyg. 1837, ii. 485.)

CHAPTER LXI.

GASEOUS POISONS—MODE OF ACTION—ASPHYXIATING AND POISONOUS GASES—CAUSE OF DEATH MISTAKEN—CARBONIC ACID—SYMPTOMS—APPEARANCES—MODE OF ACTION—ABSORPTION—TREATMENT—ANALYSIS—CHARCOAL VAPOUR—ITS EFFECTS—PRODUCTS OF BURNING WOOD—COAL AND COKE-VAPOUR—SULPHUROUS ACID—VAPOUR OF LIME AND BRICK-KILNS—CONFINED AIR—EFFECT OF CARBONIC ACID ON COMBUSTION—ITS DIFFUSION—COAL GAS—CARBURETTED HYDROGEN—CARBONIC OXIDE.

Mode of action of gaseous poisons.—In following common language, a medical jurist is obliged to apply the term suffocation to another variety of death; viz. to that of poisoning by *gases*. Physiological accuracy must here be sacrificed, in order that we may make ourselves generally intelligible. Thus, if a person die from the effect of carbonic acid,—of confined air,—of sulphuretted hydrogen, or other noxious gases, he is commonly said to die suffocated. Strictly speaking, he dies poisoned; as much so as if he had taken oxalic or hydrocyanic acid. The only differences are,—1. That the poison, instead of being liquid or solid, is *gaseous:* and—2. Instead of being applied to the mucous membrane of the stomach, it affects that of the *air-cells* of the lungs. In the case of arsenuretted hydrogen (ante, p. 93,) we have a clear instance of poisoning by a gas; and in the respiration of the narcotic vapours of chloroform and ether, we have also illustrations of this form of poisoning. Owing to the fact that the poisonous material is in a finely divided state, and that in the air-cells of the lungs it meets with a large absorbing surface, and instantly enters the blood, the effect is more rapid, and, cæteris paribus, more powerful. It has been remarked, too, that some, and probably all of these aerial poisons, have an accumulative action; *i. e.* their effect continues to increase for a short period, even after the individual has ceased to respire them.

Asphyxiating and poisonous gases.—The numerous *gases* with which chemists are acquainted are found to vary materially in their operation when introduced into the lungs; and a division has been established among them, into those which have a *negative* and into those which have a *positive* action. The former alone can be considered to cause death by asphyxia or *suffocation;* for the gases which have a positive influence must be regarded as poisons. Now, experiment has shown that there are but two gases which are essentially negative in their operation,—these are HYDROGEN and NITROGEN; all the others have a poisonous action when introduced into the body. Indeed, with regard to HYDROGEN, some doubt may be fairly entertained respecting its claim to be considered as a truly negative agent; for the researches of Allen and Pepys in this country, and the observations of Wetterstedt in Sweden, have shown that it cannot be substituted for nitrogen in atmospheric air, without inducing somnolency and lethargy. (Berzelius, Traité de Chimie, vii. 106.) If, then, we admit that the greater number of the gases are poisonous, it is scarcely correct to regard these bodies as purely asphyxiating agents. The state of lifelessness which follows their introduction into the lungs, is not to be ascribed to the simple negation of air, as in the case of drowning, hanging, or strangulation, but to a deleterious impression produced on the system, something analogous in its effects to that which is observed to follow the ingestion of a poisonous dose of hydrocyanic acid. The difference is, that the poison is aerial, and applied to the surface of the lungs instead of the stomach; but, strictly speaking, a person is no more suffocated by carbonic acid than he is by arsenuretted hydrogen.

The cause of death mistaken.—The greater number of the poisonous gases are chiefly complex products of art, and are never likely to be met with in the atmosphere so abundantly as to produce injurious consequences:—hence fatal ac-

cidents, arising from their inhalation, most commonly occur under circumstances which can leave no question respecting the real cause of death. The peculiar effects of all of these it will not be necessary to describe in this place; but there are two, a knowledge of the properties and operations of which may, on certain occasions, be required of a medical jurist:—these are, the CARBONIC ACID and SULPHURETTED HYDROGEN GASES. Agents of this description can rarely be employed with any certainty as instruments of murder; and if they were so employed, the fact could be established only by circumstantial evidence. One alleged instance of murder by carbonic acid is, however, reported by M. Devergie. (Ann. d'Hyg. 1837, i. 201.) Death, when arising from the respiration of any of the gases, is generally attributable to suicide or accident. In France it is by no means uncommon for individuals to commit self-destruction by sleeping in a closed apartment, in which charcoal has been suffered to burn; while in England, accidental deaths are sometimes heard of, where coal has been employed as fuel in small and ill-ventilated rooms. On such occasions a person may be found dead without any apparent cause to the casual observer,—the face may appear tumid and discoloured, and the cutaneous surface may be covered with ecchymosed patches. The discovery of a body under these circumstances will commonly be sufficient, in the eyes of the vulgar, to create a suspicion of murder; and some individual, with whom the deceased may have been at that period on bad terms, will, perhaps, be pointed out as the murderer. In such a case, it is obvious that the establishment of the innocence of an accused party may depend entirely on the discrimination and judgment of a medical practitioner. An instance, illustrative of the consequences of this popular prejudice, occurred in London in 1823. Six persons were lodging in the same apartment, where they were all in the habit of sleeping. One morning an alarm was given by one of them, a female, who stated that on rising she found her companions dead. Four were discovered to be really dead, but the fifth, a married man, whose wife was one of the victims, was recovering. He was known to have been on intimate terms with the female who gave the alarm, and it was immediately supposed that they had conspired together to destroy the whole party, in order to get rid of the wife. The woman who was accused of the crime was imprisoned; and an account of the supposed murder was soon printed and circulated in the metropolis. Many articles of food about the house were analyzed, in order to discover whether they contained poison, when the whole of the circumstances were explained by the man stating that he had placed a pan of burning coals between the two beds before going to sleep, and that the doors and windows of the apartment were closed. (Christison, 583.) A set of cases of a similar kind, in which there was at first a very strong suspicion of poisoning, has been lately reported in the Medical Gazette, by Mr. Smith, of Liverpool (xxxvi. 937.)

CARBONIC ACID.

Sources of.—This gas is freely liberated in respiration, combustion and fermentation; it is also extricated in the calcination of chalk or limestone, and it is abundantly diffused through the shafts and galleries of coal-mines, where it is commonly called choke-damp. Carbonic acid gas is likewise met with in wells, cellars, and other excavations in the earth. In these cases it is found most abundant generally on the soil or at the lower part of the well; and it appears to proceed from the decomposition of animal and vegetable matters confined in such situations. The slow evaporation of water strongly charged with the gas, while trickling over the sides of these excavations, may likewise assist in contaminating the air. Damp sawdust or straw slowly absorbs oxygen from a confined atmosphere, and sets free carbonic acid.

Symptoms.—The symptoms of poisoning by this gas will vary according to the degree of concentration in which it is present in the atmosphere respired. When it exists in a fatal proportion, the symptoms commonly observed are as

follow:—A sensation of great weight in the head, giddiness, a sense of constriction in the temporal regions, a ringing in the ears, with a pungent sensation in the nose; a strong tendency to sleep, accompanied by vertigo, and so great a loss of muscular power, that if the individual be at the time in an erect posture, he instantly falls, as if struck to the ground. The respiration, which is observed to be at first difficult and stertorous, becomes suspended. The action of the heart, which on the first accession of the symptoms is very violent, soon ceases. Sensibility is lost, and the person now falls into a profound coma, or state of apparent death. The warmth of the body still continues; the limbs remain flexible, but they have been observed to become rigid or even occasionally convulsed. The countenance is commonly of a livid or of a deep leaden colour, especially the eyelids and lips, but on some occasions it is stated to have been pale. The access of these symptoms has been sometimes accompanied by a pleasing sensation of delirium, while at others, the most acute pains have been suffered. In some instances there appears to have been irritability of the stomach; for the affected person has ejected the contents of the stomach in a semi-digested state. Those who have been resuscitated have often felt pain in the head, or pain and soreness over the body for several days; while, in a few severe cases, paralysis of the muscles of the face has supervened on recovery.

Post-mortem appearances.—Externally, the whole of the body appears as if it were swollen, especially the face, which is generally livid, and the features are much distorted. The cutaneous surface is covered in parts by patches of a violet hue, but, in some instances, the skin has been extremely pale; the eyes are generally prominent, and, in many cases, retain their usual brilliancy for some time after death. The body of an individual who has perished from the inhalation of carbonic acid is said to retain the animal heat, cæteris paribus, for a longer period than usual; and hence, according to Orfila, cadaverous rigidity does not commonly manifest itself until after the lapse of many hours. In a case to be related presently, the body was, however, found to have cooled considerably within the short space of two hours. On making a post-mortem inspection, the venous system is found filled with blood of a dark colour; and the vessels of the lungs and brain are observed to be especially in a state of congestion. The tongue appears swollen, and it is stated by Orfila that the mucous membrane of the intestinal canal is often interspersed with dark ecchymosed patches.

It will be seen that there is nothing very characteristic in the post-mortem appearances, and thus it is always easy to ascribe death to apoplexy or some other cause; but it should be remembered that carbonic acid itself acts by inducing apoplexy or cerebral congestion. A stove was actually allowed to be patented a few years since, the principle of which was to allow of the escape of the products of combustion in an invisible form into an apartment! There were many educated persons so ignorant as to believe that, because the fumes were invisible, they were inert; others speculated upon the quantity of carbonic acid evolved being small! The use of this stove appears to have led to the death of a man named Trickey, in St. Michael's church, in 1838, and many other serious accidents. The case of *Trickey* is in many respects worthy of the attention of the medical jurist. (See Lancet, Nov. 1838.)

Mode of action on the body.—Some difference of opinion still exists respecting the manner in which carbonic acid acts on the body. Sir Humphrey Davy ascertained that carbonic acid, in a perfectly pure state, did not pass into the trachea when an attempt was made to respire it; the glottis seemed to close spasmodically at the moment that the gas came in contact with it. On diluting the carbonic acid with about twice its volume of air, he found that he could breathe it; but it soon produced symptoms of vertigo and somnolency. In fact, in a diluted state, it is certain that it must penetrate into the lungs, or otherwise it would be impossible to explain why it should produce any other symptoms than those witnessed in the inhalation of hydrogen or nitrogen. The facts which have

been collected by Dr. Christison show, in a striking point of view, that carbonic acid is a real and energetic poison of the narcotic kind. If, as Nysten supposed, it had a negative effect when respired, it ought to follow, that it might be substituted for nitrogen in the proportion in which that gas exists in atmospheric air. But a mixture of carbonic acid and oxygen in atmospheric proportions, has been shown by M. Collard de Martigny to produce rapidly fatal effects upon the animal system. Such a mixture cannot be breathed, even for a period of two minutes, without giving rise to serious symptoms.

Absorption.—When the gas enters into the pulmonary cells, it is probably *absorbed* by the blood and circulated with that fluid throughout the body. Its specific action on the brain may be inferred from the headache, vertigo, somnolency and coma, which follow its introduction, as also from the loss of muscular power in persons labouring under its effects, as well as the paralysis which is sometimes seen in those who have recovered.

Poisonous proportions.—A very small proportion of carbonic acid, when respired for a certain time in combination with air, will suffice to destroy life in man or in any of the higher orders of animals. It is generally admitted by physiologists, that an atmosphere containing more than *one-tenth* of its volume of carbonic acid, will, if introduced into the lungs, speedily prove fatal to human life. M. Guérard has lately called in question the general opinion that carbonic acid is very fatal to life. He says it may be mixed in very large proportions with atmospheric air without causing death, and attributes the noxious effects of charcoal-vapour to carbonic oxide, which, he says, will prove fatal when in the proportion of only four or five per cent. (Ann. d'Hyg. 1843, ii. 54.) If M. Guérard had extended his experiments to the Grotto del Cane, at Pozzuoli, near Naples, he would have found that mixtures which he describes as innocent, are speedily fatal to animal life. The air of the Grotto is a mixture of carbonic acid, common air, and aqueous vapour: it contains no carbonic oxide; and I have not only witnessed its fatal effects on animals, but have myself experienced the incipient symptoms of poisoning by carbonic acid from respiring it.

It is necessary in these cases to make a distinction between the contamination of air from the admixture of free carbonic acid, and the case where the carbonic acid is formed by combustion or respiration in a close apartment, at the expense of the oxygen actually contained in air. Every volume of carbonic acid formed by combustion indicates an equal volume of oxygen removed. Such an atmosphere is, cæteris paribus, more destructive than another where the air and gas are in a state of simple admixture. If we assume that in each case the noxious atmosphere contains ten per cent. of carbonic acid, then in the case of combustion there will be seven per cent. less of oxygen and seven per cent. more of nitrogen, than where the gases are mixed, since the production of ten parts of carbonic acid implies the loss of ten parts of oxygen. This difference in the proportions may not be, practically speaking, correct; because there is no apartment sufficiently closed to prevent air rushing in from the exterior while combustion is going on within it; but nevertheless, the above statement may be taken as an approximation to the truth. When the gas is respired in the lowest poisonous proportion, the symptoms come on more slowly, and the transition from life to death is frequently tranquil: this is what we learn from the histories of suicides. The symptoms in such cases appear to resemble closely those which indicate the progressive influence of opium, or any other narcotic poison, on the body.

Treatment.—The best means for resuscitation are the employment of artificial respiration and cold affusion, with stimulating embrocations to the chest and extremities. If the surface be cold, a warm bath should be employed, and on the appearance of any signs of recovery, if there should be congestion of the cerebral vessels, venesection may be performed. If at hand, oxygen gas may be introduced into the lungs. A case, in which the use of this gas is said to have been successful, is quoted in the Lancet, July 26, 1844, p. 531. Oxygen

gas was used for this purpose nearly forty years ago, by the late Dr. Babington. (Med. Chir. Trans. i. Art. 8.)

Analysis.—Sometimes a medical jurist may be required to state, for the purposes of justice, the nature of the gaseous mixture in which a person may have died. He will have but little difficulty in determining whether carbonic acid be the deleterious agent in such a mixture. When it exists in a confined atmosphere, its presence may be identified, if previously collected in a proper vessel, by the following characters. 1. It extinguishes a taper if the proportion be above twelve or fifteen per cent.; and from the extreme density of the gas, the smoke of the extinguished taper may be commonly seen to float on its surface. 2. Lime-water, or a solution of subacetate of lead, is instantly precipitated white when poured into a jar of the gas; and the precipitate thus formed may be collected by filtration, and proved to possess the well known properties of carbonate of lime or lead. Air containing only one per cent. of carbonic acid scarcely affects lime-water. 3. When a solution of chloride of lime, coloured by litmus, is added, the blue colour, on agitating the liquid in the gas, is discharged. This clearly distinguishes carbonic acid from nitrogen. The *proportion* in which carbonic acid exists in a mixture, may be determined by introducing into a measured quantity, in a graduated tube over mercury, a strong solution of caustic potash. Absorption will take place after a certain time, and the degree of absorption will indicate the proportion of carbonic acid present. When this destructive agent exists in a confined spot, as in a well or cellar, it may be generally got rid of by placing within the stratum a pan containing the hydrate of lime loosely mixed into a paste with water,—by exciting combustion at the mouth of the pit, or what is better, when available, by a jet of high pressure steam. [Probably the most effective agent for its removal is the strong liquor ammoniæ, which has been lately recommended, or the hydrate of lime (common white-wash) mixed with a small proportion of carbonate of ammonia.—H.] Lives are often successively lost on these occasions in consequence of one individual descending after another, in the foolish expectation of at least being able to attach a rope to the body of his companion. The moment that the mouth falls within the level of the stratum, all power is lost, and the person commonly sinks lifeless. The gas may be collected by lowering a bottle filled with fine sand by means of a string attached to the neck, and guiding the bottle by another string attached to its base. When the bottle is within the stratum, it should be turned with its mouth downwards, and when the sand has fallen out, rapidly raised with its mouth upwards, by pulling the string attached to the neck.

CHARCOAL-VAPOUR.

Products of burning charcoal.—The gas extricated during the combustion of charcoal, according to the experiments of Orfila, is not pure carbonic acid, but a very compound mixture. It operates fatally when respired, chiefly in consequence of the carbonic acid contained in it: the proportion of this gas is, however, subject to variation, according to whether the combustion be vivid or not. When the charcoal burns vividly, the quantity of carbonic acid is, according to Orfila, less than when it is either nearly extinguished or beginning to burn. In the former case, the carbonic acid is in the proportion of about eleven per cent. by volume—in the latter, the proportion amounts to about fourteen per cent.; the remainder of the mixture is made up of air, of free nitrogen, and of a portion of carburetted hydrogen, if the charcoal be not too intensely ignited. (Orfila.)

Symptoms and post-mortem appearances.—The following case, illustrating the effects of charcoal-vapour, has been reported by Mr. Collambell. (Med. Gaz. xxvii. 693.) In January, 1841, a man was engaged to clean the windows of three small rooms on the basement-story of a house. The first room had a door opening into a courtyard—the others merely communicated with each other by a central door, and there was no fire-place in any one. A brazier of burning

charcoal had been placed in the outer room for the purpose of drying it, but it appeared that the deceased had shut the outer door, and had removed the brazier into the inner room of the three, leaving the communicating doors open. In *two hours* the man was found quite dead, lying on the floor of the middle room. The countenance was pale, as well as the whole of the skin; the eyes were bright and staring, the pupils widely dilated; the lips exsanguine; the jaw firmly fixed; the tongue protruding, and the face and extremities cold. Some frothy mucus had escaped from the mouth. The person who discovered the deceased found the ashes in the brazier still burning, and he experienced great oppression in breathing. An inquest was held without an inspection, and a verdict of accidental death returned. The body was afterwards privately inspected by Mr. Collambell. On opening the head, the vessels on the surface of the brain were found highly distended with dark liquid blood; the pia mater was bedewed with serum. The brain was of unusually firm consistence, and numerous bloody points appeared on making a section of it. The lateral ventricles were distended with about an ounce and a half of pale serum, and the vessels of the plexus choroides were much congested. The cerebellum was firm, and presented on section numerous bloody points. About two ounces of serum, tinged with blood, were collected from the base of the skull. The lungs had a slate colour. On the left side of the chest there were eight ounces of serum, tinged with blood, and nearly an equal quantity on the right side. On cutting into the organs, a large quantity of serous fluid, mixed with blood, escaped. The bronchial tubes were filled with a frothy fluid tinged with blood. The pericardium contained an ounce of pale serum: the heart was enlarged; the cavities contained no blood: the liver and kidneys were, however, much gorged. There was no doubt that the cause of death was the inhalation of charcoal-vapour; and it is probable that the man died from respiring but a comparatively small proportion. The capacity of the chambers must have nearly reached two thousand cubic feet: the deceased had been there only two hours, and when the person who discovered him entered the rooms, the air was not so vitiated but that he could breathe, although with some oppression. The fuel was then in a state of combustion. In one case which was referred to me for examination in 1851, there was a considerable effusion of blood in the submucous tissue of the stomach. This appearance led to a strong suspicion of irritant poisoning. In one fatal case there was copious bleeding from the nose. (Med. Gaz. xlvii. p. 412.)

Power of locomotion.—It often excites surprise on these occasions that no exertion is made to escape, when it would apparently require but very slight efforts on the part of the individual. The fact is, that the action of the vapour is sometimes very insidious; one of its first effects is to create an utter prostration of strength, so that even on a person awake and active, as in the case above related, the gas may speedily produce a perfect inability to move or to call for assistance. For some remarks on the action of charcoal-vapour, by Dr. Bird, see Guy's Hospital Reports, April, 1839; and for a case illustrative of the dangerous effects of the diluted vapour, see Ed. Med. and Surg. Journ. i. 541. In this instance, a charcoal brazier was left only for a short time in the cell of a prison. It was removed, and the prisoners went to sleep. They experienced no particular effects at first, but after some hours, two were found dead. Thus, then, an atmosphere which may be breathed for a short time with impunity, may ultimately destroy life.

In a case of alleged murder by carbonic acid, which occurred in Paris a few years since, a question was put to the medical witnesses, respecting the *quantity of charcoal* required to be burnt in a particular chamber in order to asphyxiate two adult individuals. (Ann. d'Hyg. 1837, i. 201; 1840, 176; also, Brit. and For. Rev. xi. 240, and xxiii. 264.) This question could of course only be answered approximately; because in burning charcoal, the sole product is not carbonic acid, and the substance itself is by no means pure carbon. Then, again,

much of the carbonic acid formed may escape in various ways from an imperfectly closed apartment. An attempt was made to infer the quantity of charcoal consumed, from the weight of ashes found in the apartment; but no satisfactory answer could be given to the question. The prisoner was, however, convicted of murdering his wife by carbonic acid.

Products of burning wood.—M. Devergie has shown that the slow combustion of wood may lead to the evolution of a noxious vapour, and give rise to dangerous consequences (Ann. d'Hyg. 1835, i. 442.) His remarks have been recently confirmed by two cases published by MM. Bayard and Tardieu. A man and his wife were found dead in bed. There was a smoky vapour in the apartment, but no fire had been lighted in the grate, and the chimney was blocked up. The planks of the floor were widely separated, and there was a large hole in the boards at the foot of the bed, communicating with the apartment below. It was found, on examination, that some joists connected with the flue of an iron plate, which had been heated for making confectionary the previous day, were in a smouldering state; that the vapour had entered the bedroom of the deceased through the crevices in the floor, and not finding a vent by the chimney, had led to these fatal results. It is remarkable that the source of combustion was nearly nine yards distant, and one person, who slept nearer to the flue of the iron plate, entirely escaped. In the husband, the skin was of a reddish tint, the blood liquid, the cavities of the heart empty, the lungs gorged, and there were no subpleural ecchymoses. In the wife there was less redness of the skin, the blood was coagulated in the cavities of the heart, principally on the right side, extending to the vessels; less engorgement of the lungs, and a great number of subpleural ecchymoses, indicating that strong efforts had been made to respire. There was at first a rumour of poisoning, which was only disproved by a close examination of the locality. (Ann. d'Hyg., Oct. 1845, 362.)

COAL AND COKE-VAPOUR. SULPHUROUS ACID.

Products from burning coal and coke.—The gases extricated in the smothered combustion of coal are of a compound nature. In addition to carbonic acid, we may expect to find in the atmosphere of a close room, in which such a combustion has been going on, SULPHUROUS ACID GAS, and the sulphuretted and carburetted hydrogen gases. These emanations are equally fatal to life; but in consequence of their very irritating properties, they give warning of their presence, and are therefore less liable to occasion fatal accidents. The sulphurous acid gas, when existing in a very small proportion in air, has the power of irritating the glottis so violently, that, if accidentally respired, it would commonly compel the individual to leave the spot before the vapours had become sufficiently concentrated to destroy life. Nevertheless, accidents from the combustion of coal sometimes occur.

Symptoms and appearances.—The following cases will convey a knowledge of the symptoms and post-mortem appearances which are commonly met with on these occasions. Some years since, four individuals, in a state of asphyxia, were brought to Guy's Hospital. It appeared that on the evening before, they had shut themselves up in the forecastle of a coal-brig, and had made a fire. About six or seven o'clock the same evening, some of the crew accidentally placed a covering over the fire on the outside, and thus stopped the escape of smoke from the fire, which was made of a kind of coal containing much sulphur. Early in the morning, one of the crew, on opening the hatches, observed three of the inmates lying on the floor senseless and frothing at the mouth; the fourth in his crib, in a similar condition. The air in the place was most offensive. After the men were brought on deck, one of them, aged twenty-one, began to recover, and when brought to the hospital, he seemed only giddy, as if intoxicated. He soon completely recovered. Another, aged forty, after breathing oxygen gas and having brandy and ammonia exhibited to him, showed no symptoms of recovery,

but died in a few hours. A third, aged seventeen, soon began to rally, and in a few hours was perfectly enabled to answer questions; he declared that he felt no pain, sense of oppression or weight, either in his head or chest. The fourth, aged fifteen, died the following day, having exhibited no symptom of rallying. Stimulants were administered internally, and warm fomentations were used, but all efforts to produce reaction failed. The appearance of the individuals when brought in, was as follows:—lips purple, countenance livid, surface of the body cold, hands and nails purple, respiration very quick and short; pulse small, quick, and feeble; pupils fixed, and there was total insensibility. The body of the man, aged forty, was inspected four hours after death. The membranes of the brain were congested, and there was a large quantity of fluid under the tunica arachnoides. The sinuses were gorged with blood. The lungs were in a state of great congestion, as also the right cavities of the heart. It was remarked, that this corpse was similar in appearance to that of an executed culprit. The body of the lad, aged fifteen, was inspected about thirty-three hours after death. Under the pia mater was observed one small ecchymosed spot; in the substance of the brain there were more bloody points than usual; a small quantity of fluid was found under the tunica arachnoides, and the sinuses were full of coagulated blood. The lungs showed no congestion, but the right cavities of the heart were much distended with blood. (For an account of two cases of recovery from the effects of coal-vapour, see Med. Gaz. ix. 935.; also, Dub. Med. Press, Jan. 31, 1849, p. 69, and Med. Gaz. xliii. p. 937.)

An interesting case of the fatal effects of coal-vapour has been published by Dr. Davidson. The man lost his life from sleeping in a closed room with a fire to which there was no flue. The lungs were found gorged with blood, and the trachea and bronchi were filled with a frothy muco-sanguineous fluid; the mucous membrane beneath was slightly injected. There was a small effusion in each pleural cavity. The right side of the heart was full of dark liquid blood. The dura mater was much injected; the sinuses of the brain and the veins of the pia mater were completely congested, and there was sub-arachnoid effusion. The substance of the brain, when cut, presented numerous bloody points. (Month. Jour., April, 1847, 763.) In the Medical Times and Gazette, (April, 3, 1852, p. 353,) the reader will find an account of three cases of recovery from the effects of coal-vapour.

[Several interesting cases are related by Briand (*Man. Comp. de Méd. Lég.* 5th ed. 416, 419) to show the importance of closely examining the localities in those cases of asphyxia where the source of the deleterious gas is not very evident. (See ante, p. 526, in relation to suspicion of poisoning.) In one of these cases a man and wife were found dead in bed suffocated by gas produced by the charred wood work in the neighbourhood of a fire in a room at the opposite end of a long corridor on the same floor. The gas had worked its way under the floor until it found a vent in a crack of the flooring of the unfortunate couple's chamber. In other instances the gas was drawn through stove pipes, and from one chimney flue to another on different floors.—H.]

Analysis.—Sulphurous acid is immediately known by its powerful and suffocating odour, which resembles that of burning sulphur. The best test for its presence is a mixture of iodic acid and starch, which speedily acquires a blue colour when exposed to the vapour.

VAPOUR OF LIME AND BRICK-KILNS.

Gaseous products from lime-burning.—In the burning of lime, carbonic acid is given out very abundantly and in a pure form. It has been owing to the respiration of the gas thus extricated, that persons who have incautiously slept in the neighbourhood of a burning lime-kiln during a severe winter, have been destroyed. The discovery of a dead body in such a situation would commonly suffice to demonstrate the real cause of death; but a practitioner ought not to be the less prepared to show that there existed no other apparent cause of death

about the person. It is obvious that an individual might be murdered, and his body placed subsequently near the kiln by the murderer, in order to avert suspicion. If there be no external marks of violence, the stomach should be carefully examined for poison: in the absence of all external and internal lesions, medical evidence will avail but little; for a person might be criminally suffocated, and his body, if found under the circumstances above stated, would present no appearances upon which a medical opinion could be securely based. An accident is related by Foderé to have occurred at Marseilles in 1806, where seven persons of a family were destroyed in consequence of their having slept on the ground-floor of a house, in a court-yard of which a quantity of limestone was being burnt into lime. They had evidently become alarmed, and had attempted to escape; for their bodies were found lying in various positions. The court-yard was enclosed, and the carbonic acid had poured into the apartment through the imperfectly-closed window and door. In November, 1838, a man died three days after being exposed to the vapours of a lime-kiln. (Guy's Hosp. Rep., April, 1839.) The vapour of a brick-kiln is equally deleterious, the principal agent being carbonic acid, although I have found that ammonia and muriatic acid are also abundantly evolved. In September, 1842, two boys were found dead on a brick-kiln near London, whither they had gone for the purpose of roasting potatoes. Although the cause of death in the two cases was clearly suffocation, in one instance the body was extremely livid, while in the other there was no lividity whatever! Such accidents are very frequent. In November, 1844, an inquest was held at Manchester on the body of a man who had died under similar circumstances.

CONFINED AIR.

Symptoms and effects.—An animal confined within a certain quantity of air, which it is compelled to respire, will soon fall into a state of lifelessness. A human being in the same way may be suffocated, if confined in a close apartment where the air is not subject to change or renewal, and this effect is hastened when a number of persons are crowded together in a small space. The change which air, thus contaminated by respiration, undergoes, may be very simply stated. The quantity of nitrogen in a hundred parts will remain nearly the same; the quantity of oxygen will probably vary from eight to twelve per cent., while the remainder will be made up chiefly of carbonic acid. Such air will also have a high temperature, if many persons are crowded together, and will be saturated with aqueous vapour containing animal matter poured out by the pulmonary and cutaneous exhalants. From this statement, it is evident that air which has been contaminated by continued respiration will operate fatally on the human system, partly in consequence of its being deficient in oxygen, and partly from the deleterious effects of the carbonic acid contained in it. The proportion in which carbonic acid exists in respired air must be subject to great variation; according to the experiments of Allen and Pepys, it never exceeds ten per cent. by volume of the mixture, how frequently soever it may have been received into and expelled from the lungs. Dalton found that the air in crowded rooms contained about one per cent. of carbonic acid, the atmospheric proportion being therefore increased tenfold. It is certain that insensibility and death would ensue in a human adult, before the whole of the oxygen of the confined air had disappeared; but the opportunity can rarely present itself of analyzing such a contaminated mixture, and hence it is impossible to specify the exact proportion in which carbonic acid would exist, when the confined air had proved fatal to persons who had respired it. M. Lassaigne has shown, by direct experiment, that the carbonic acid in the air of close rooms is not collected on the floor, but equally diffused throughout. The whole mass of air is in fact vitiated, and requires renewal. (Med. Gaz. xxxviii. 351.)

Combustion in mixtures containing carbonic acid.—In reference to poisoning by carbonic acid, there is one circumstance which requires attention. It is a matter

of popular belief, and, in fact, it is generally asserted by writers on asphyxia, that the burning of a candle in a suspected mixture of carbonic acid and air, is a satisfactory proof that it may be respired with safety. Recent observations have, however, tended to show that this statement is not to be relied on as affording an indication of security. A case is related by Dr. Christison, where a servant, on entering a cellar in which grape-juice was fermenting, was suddenly seized with giddiness. She dropped her candle on the floor, but had time to leave the cellar and shut the door behind her, when she fell down senseless. Those who went to her assistance found, on opening the door, that the candle was still burning. Another case is referred to, where, in an attempt at suicide, on entering the apartment, the person was discovered to be in a state of deep coma, while the pan of charcoal was still burning; and in an instance just now related, the same fact was observed. The results of some experiments on this subject have led me to the conclusion that a candle will burn in air which is combined with even ten or twelve and a half per cent. of its volume of carbonic acid gas, and although such mixtures might not prove immediately fatal to man, yet they would soon give rise to giddiness, vertigo, insensibility, and ultimately death, in those who, after having been once immersed in them, did not hasten to quit the spot. In air containing a smaller proportion than this,—(five or six per cent.,)—a candle will readily burn; but it is probable that such a mixture could not be long respired without causing fatal symptoms: hence the *burning of a candle can be no criterion of safety* against the effects of carbonic acid. It is perfectly true that, in gaseous mixtures where a candle is extinguished, it would not be safe to venture; but the converse of this proposition is not true; namely, that a mixture in which a candle burns may be always respired with safety.

Diffusion of carbonic acid.—Of late years some important medico-legal questions have arisen, relative to the diffusion of this gas in air, when produced by combustion. It has been supposed that, owing to its great specific gravity (1.527,) it would collect on the floor of an apartment, would gradually rise upwards, and suffocate individuals at different times, according to the level on which they might happen to be placed. Questions on this point have been variously answered, and great difference of opinion has arisen on the subject. Medical witnesses have often lost sight of two important points on which a correct answer to this inquiry must be based:—1. The law of the diffusion of gases; and, 2. The effect of heat in greatly diminishing the specific gravity of a gas naturally heavy. There is no doubt that, in a narrow or confined vessel, exposed to air, carbonic acid is slow in escaping,—nevertheless it mixes and passes off with the air;—and in the course of an hour or two, in spite of its great specific gravity, none will be contained within the vessel. The well known Grotto del Cane, at Pozzuoli, has been referred to by those who hold that carbonic acid always tends to remain on the lowest level; but it has been forgotten that in this, and other similar cases, carbonic acid is continually issuing from crevices in the soil, so that that which is lost by diffusion is continually replaced; hence the illustration proves nothing. It may suffice to state, that air and carbonic acid mix readily on contact in all proportions, although they enter into no chemical combination. Thus, then, at common temperatures, carbonic acid has no tendency to remain on the floor or soil, when there is a free access of air or contact with other gases. The heat of combustion diminishes the specific gravity of the gas, and the carbonic acid therefore ascends with the heated current of air, and diffuses itself in the upper part of an apartment where there are no means of carrying it off. This is a fact demonstrable by many simple experiments. In burning a quantity of charcoal actively in an open brazier raised above the floor in a large apartment, I found that the proportion of carbonic acid was nearly equal in air taken from a foot above and a foot below the level of the source of combustion, there being no currents to affect the results. Hence it follows that carbonic acid produced by combustion has no particular tendency to collect at the lowest level; that it is uniformly diffused around, and probably it would be found,

by careful experiments, that within apartments of small dimensions—those in which individuals are often accidentally suffocated—the upper strata of air contain as much or even more carbonic acid than the lower. For this reason, an apartment with a low ceiling is more dangerous, under these circumstances, than one which is lofty.

Summary.—In a very large apartment, it would of course be improper to test the suffocating properties of the air by the examination of it at a great distance from the source of combustion; since a person situated near this spot might be destroyed, while one at a distance might escape—the carbonic acid not having completely diffused itself; or supposing it to have become entirely diffused, the proportion may be so small as to render it harmless. It is well known, by the effects of the vapour of a lime-kiln, that one lying at the edge of the kiln may be destroyed, while another at ten yards' distance, either on the same level or below it, may entirely escape; and it would not be possible, in such a case, to speculate upon the proportion of carbonic acid which had destroyed life, except by collecting the air from the spot where the accident occurred, and at or about the time of its occurrence. Another fallacy appears to be, that because a dead body is found recumbent, it is to be inferred that the individual must have lain down and been destroyed while sleeping. The body of a dead person must always be found thus lying on a floor, unless it be supported; but suffocation may have actually taken place, or at least have commenced, when the deceased was in the sitting or erect posture. Admitting that carbonic acid diffuses itself rapidly from combustion in a small and closed apartment, it has been supposed that after having become mixed with the air, it would again in great part separate, and, owing to its superior density, fall to the lowest level on cooling. In answer to this it may be said,—1. That there are no facts to support the opinion, while there are many against it; for we do not find that the heaviest and lightest gases, when once really mixed, ever again separate from each other.—2. Practically this explanation amounts to nothing; because before the gas had cooled and reacquired its density, its asphyxiating properties would probably have had their full effect on all living persons within its reach. Persons are not suffocated by carbonic acid after the fuel is extinguished and the apartment cooled; but the poisonous action of the gas is commonly manifested while the fuel is still burning. The inferences which, it appears to me, we are entitled to draw from the preceding considerations, are,—1. That in a small and close apartment, individuals are equally liable to be suffocated at all levels, from the very equal and rapid diffusion of carbonic acid during combustion.—2. That in a large apartment, unless the gas be very rapidly diffused by a current of air, —the air around the source of combustion may become impregnated with a poisonous proportion, while that at a distance might be still capable of supporting life, because carbonic acid requires time for its perfect and equable diffusion in a very large space.

COAL-GAS. CARBURETTED HYDROGEN. CARBONIC OXIDE.

Since the introduction of coal-gas for the purposes of illumination, many fatal accidents have occurred from the respiration of air contaminated with it. Coal-gas is a compound body, acting as a direct poison when respired. Its composition is subject to much variation, according to circumstances. Mitscherlich found that it was principally composed of light carburetted hydrogen, hydrogen, and carbonic oxide, in the proportions of 66 per cent. of the first, 21·3 of the second, and 11 of the third. M. Tourdes found that the proportions of light carburetted hydrogen and carbonic oxide were nearly equal, *i. e.* about 22 per cent. The difference in composition depends on the heat to which the gas has been submitted. Some consider that CARBONIC OXIDE is the poisonous principle; but there is no doubt that the hydro-carbons also have a noxious influence, although the use of the safety-lamp in mines proves that a mixture of protocarbu-

retted hydrogen with air in a small proportion may be respired without producing serious effects.

Symptoms and post-mortem appearances.—The symptoms produced by coal-gas when mixed in a large proportion with air, are vertigo, headache, nausea with vomiting, confusion of intellect with loss of consciousness, general weakness and depression, partial paralysis, convulsions, and the usual phenomena of asphyxia. The post-mortem appearances will be best understood from the following cases. In January, 1841, a family residing at Strasburg respired for forty hours an atmosphere contaminated with coal-gas which had escaped from a pipe passing near the cellar of the house where they lodged. On the discovery of the accident, four of the family were found dead. The father and mother still breathed, but in spite of treatment, the father died in twenty-four hours: the mother recovered. On a post-mortem examination of the five bodies there was a great difference in the appearances; but the principal points observed were congestion of the brain and its membranes, the pia mater gorged with blood, and the whole surface of the brain intensely red. In three of the cases, there was an effusion of coagulated blood on the dura mater of the spinal canal. The lining membrane of the air-passages was strongly injected, and there was spread over it a thick viscid froth tinged with blood; the substance of the lungs was of a bright red colour, and the blood was coagulated. (Ann. d'Hyg. Jan. 1842.) In two cases communicated by Mr. Teale to the Guy's Hospital Reports (No. viii.,) there was found congestion of the brain and its membranes, with injection of the lining membrane of the air-passages. In these cases the blood was remarkably liquid. The circumstances under which the accident occurred were very similar. An old lady and her grand-daughter, who had been annoyed by the escape of gas during the day, retired to bed, and were found dead about twelve hours afterwards.

In the cases above given, the effects produced by coal-gas were owing to the long-continued respiration of it in a diluted state. The quantity contained in the air of the rooms must have been very small; in M. Tourdes' case it was probably not more than 8 or 9 per cent., because a little above this proportion the mixture with air becomes explosive, and there had been no explosion in this case, although in the apartment in which the individuals were found dead, a stove had been for a long time in active combustion, and a candle had been completely burnt out. In Mr. Teale's case, those who entered the house perceived a strong smell of coal-gas; but still the air could be breathed. Coal-gas, therefore, like other aërial poisons, may destroy life if long respired, although so diluted as not to produce any serious effects in the first instance! This gas owes its peculiar odour to the vapour of naphtha: the odour begins to be perceptible in air when the gas forms only the 1000th part: it is easily perceived when forming the 700th part, but the odour is well marked when it forms the 150th part (Tourdes.) In most houses where gas is burnt, the odour is plainly perceived; and it is a serious question whether health and life may not often be affected by the long continued respiration of an atmosphere containing but a small proportion. The odour will always convey a sufficient warning against its poisonous effects. It should be known that this gas will penetrate into dwellings in a very insidious manner. In Mr. Teale's cases, the pipe from which the gas had escaped was situated about ten feet from the wall of the bed-room where the females slept. The gas had permeated through the loose earth and rubbish, and entered the apartment through the floor! It is impossible to determine exactly what proportion of this gas in air will destroy life. An atmosphere containing from 7 to 12 per cent. has been found to destroy rabbits and dogs in a few minutes: when the proportion was from 1½ to 2 per cent. it had little or no effect. With respect to man, it may destroy life if long respired when forming about 9 per cent., *i. e.* when it is in less than an explosive proportion. (See B. and F. Med. Rev. xxix. 253; also, Ann. d'Hyg. 1830, i. 457.)

M. Tourdes has ascertained that rabbits died in twenty-three minutes when

kept in an atmosphere containing 1-15th of its bulk of pure *carbonic oxide*. When the proportion was 1-30th, they died in thirty-seven minutes, and when 1-8th, in seven minutes. The action of this gas on the body is that of a pure narcotic: it appears to be a powerful poison.

Analysis.—The circumstances under which the accident occurs will generally suffice to establish the nature of the gas. Coal-gas burns with a bright white light, producing carbonic acid and water. A taper should be cautiously applied to a small quantity; since, when the gas is mixed with air in the proportion of from 11 to 14 per cent., it is dangerously explosive. For this reason no lighted candle should be taken into an apartment where an accident has occurred, until all the doors and windows have been for some time kept open. The combustion of the gas, or its explosion with air, is a sufficient test of its nature; the peculiar odour, and the want of action on a salt of lead, will distinguish it from sulphuretted hydrogen.

Carbonic oxide is known by the fact that when kindled it burns with a pale blue light, and produces carbonic acid and water by its combustion.

CHAPTER LXII.

SULPHURETTED HYDROGEN GAS—ITS POISONOUS PROPERTIES—SYMPTOMS—POST-MORTEM APPEARANCES—EFFLUVIA OF DRAINS AND SEWERS—ANALYSIS—MEPHITIC VAPOURS—EXHALATIONS OF THE DEAD.

Poisonous proportions.—SULPHURETTED HYDROGEN, in a toxicological point of view, may be considered next in importance to carbonic acid. Individuals are occasionally accidentally killed by it; but the very offensive odour which a small portion of it communicates to a large quantity of air, is sufficient to announce its presence, and to prevent any dangerous consequences from taking place. The sulphuretted hydrogen gas, when respired in its pure state, is almost instantaneously mortal. It exerts equally deleterious effects upon all orders of animals, and upon all the textures of the body. It has been found to destroy life even when it is allowed to remain in contact with the skin. Mr. Donovan states that a rabbit enclosed in a bladder of sulphuretted hydrogen gas, but allowed to breathe freely in the atmosphere, perished in ten minutes. When introduced into the lungs of animals, even in a very diluted state, it has been known to give rise to fatal consequences. Thus Thénard found that air which contained only one eight-hundredth of its volume of this gas, would destroy a dog; and that when the gas existed in the proportion of one two-hundred and fiftieth, it sufficed to kill a horse. The later researches of M. Parent-Duchâtelet, however, seem to show that the poisonous effects of the gas have been somewhat exaggerated, at least in the application of these results to man. He observed that workmen breathed with impunity an atmosphere containing one per cent. of sulphuretted hydrogen; and he states that he himself respired, without serious symptoms ensuing, air which contained *three per cent.* In most drains and sewers, rats and other vermin are found to live in large numbers; and, according to Gaultier de Claubry, the air in those localities contains from two to eight per cent. (Devergie, ii. 520.) Thus admitting it to be a poison even more powerful than carbonic acid, it does not appear to be so energetic as Thénard's experiments would lead us to suppose. An atmosphere containing from six to eight per cent. of the gas might speedily kill, although nothing certain is known of the smallest proportion required to destroy human life. One fact, however, is worthy of the attention of medical jurists, namely, that the respiration of an atmosphere only slightly impregnated with the gas, may, if long continued, seriously affect an

individual, and even cause death. M. d'Arcet had to examine a lodging in Paris, in which three young and vigorous men had died successively, in the course of a few years, under similar symptoms. The lodging consisted of a bedroom with a chimney, and an ill-ventilated ante-room. The pipe of the privy passed down one angle of the room by the head of the bed, and the wall in this part was damp from infiltration. At the time of the examination there was no perceptible smell in the room, although it was small and low. M. d'Arcet attributed the mortality in the lodging to the slow and long-continued action of the emanations from the pipe; and it is highly probable that this was the real cause. (Ann. d'Hyg. Juillet, 1836.) The men who were engaged in working at the Thames Tunnel suffered severely during the excavation from the presence of this gas in the atmosphere in which they were obliged to work. The case was referred to me for examination by Sir I. M. Brunel, in 1839. The air as well as the water which trickled through the roof, was found to contain sulphuretted hydrogen:—it was probably derived from the action of the water on the iron-pyrites in the clay. The gas issued in sudden bursts, so as to be at times perceptible by its odour. By respiring this atmosphere, the strongest and most robust men were, in the course of a few months, reduced to an extreme state of exhaustion, and several died. The symptoms with which they were first affected were giddiness, sickness, and general debility: they became emaciated, and fell into a state of low fever, accompanied by delirium. In one case which I saw, the face of the man was pale, the lips of a violet hue, the eyes sunk, with dark areolæ around them, and the whole muscular system flabby and emaciated. Chloride of lime and other remedies were tried for the purification of the air; but the evil did not entirely cease until the tunnel was so far completed that there was a communication from one side to the other, and free ventilation throughout.

Symptoms.—The symptoms produced by sulphuretted hydrogen on the human system vary according to the degree of concentration in which it is respired. When breathed in a moderately diluted state, the person speedily falls inanimate. An immediate removal to pure air, venesection, and the application of stimulants, with cold affusion, may, however, suffice to restore life. According to the account given by those who have recovered, this state of inanimation is preceded by a sense of weight in the epigastrium and in the region of the temples; also by giddiness, nausea, sudden weakness, and loss of motion and sensation. If the gas in a still less concentrated state be respired for some time, coma, or tetanus with delirium, supervenes, preceded by convulsions or pain and weakness over the whole of the body. The skin, in such cases, is commonly cold, the pulse irregular, and the respiration laborious. When the air is but very slightly contaminated by the gas, it may be breathed for a long time without producing any serious symptoms: sometimes there is a feeling of nausea, or sickness, accompanied by pain in the head, or diffused pains in the abdomen. These symptoms are often observed to affect those who are engaged in chemical manipulations with this gas. Sulphuretted hydrogen appears to act like a narcotic poison when highly concentrated; but like a narcotico-irritant when much diluted with air. It is *absorbed* into the blood, to which it gives a brownish-black colour, and it is in this state circulated throughout the body. For an interesting case of poisoning by this gas, in which the person recovered, see Med. Gaz. vol. xlviii. p. 871.

Post-mortem appearances.—On examining the bodies of persons who have died from the effects of sulphuretted hydrogen, the following appearances have been observed. The mucous membrane of the nose and fauces is commonly covered by a brownish viscid fluid. A highly offensive odour is exhaled from all the cavities and soft parts of the body. These exhalations, if received into the lungs of those engaged in making the inspection, sometimes give rise to very unpleasant symptoms, and may even cause syncope or asphyxia. The muscles of the body are of a dark colour, and are not susceptible of the galvanic stimulus. The lungs, liver, and the soft organs generally, are distended with black liquid

blood. There is also great congestion about the right side of the heart, and the blood is said not to become coagulated after death: the body rapidly undergoes the putrefactive process.

Effluvia of drains and sewers.—The most common form of accidental poisoning by sulphuretted hydrogen, for it is rare that a case occurs which is not purely accidental, is witnessed among nightmen and others who are engaged in cleaning out drains and sewers, or in the removal of the soil of privies. These accidents are much more frequent in France than in England, the soil being often allowed to collect in such quantities in Paris and other large continental cities, as to render the removal of it a highly dangerous occupation for the workmen. According to the results of Thénard's observations, there are two species of compound gases, or mechanical mixtures of gases, which are commonly met with in the exhalations of privies. The first compound consists of a large proportion of atmospheric air holding diffused through it, in the form of vapour, the *hydrosulphuret of ammonia*. The hydrosulphuret is contained abundantly in the water of the soil, and is constantly rising from it in vapour, and diffusing itself in the surrounding atmosphere. It is this vapour which gives the highly unpleasant odour, and causes an increased secretion of tears in those who unguardedly expose themselves to such exhalations. The *symptoms* produced by the respiration of this gaseous mixture when in a concentrated state, bear a close resemblance to those which result from the action of sulphuretted hydrogen gas. If the person be but slightly affected, he will probably complain of nausea and sickness; his skin will be cold, his respiration free but irregular; the pulse is commonly frequent, and the voluntary muscles, especially those of the chest, are affected by spasmodic twitchings. If more seriously affected, he loses all power of sense and motion, the skin becomes cold, the lips and face assume a violet hue, the mouth is covered by a sanguineous mucus, the pulse is small, frequent, and irregular; the respiration hurried, laborious, and convulsive; and the limbs and trunk are in a state of general relaxation. If still more severely affected, death may take place immediately, or should the person survive a few hours, in addition to the above symptoms, there will be short but violent spasmodic twitchings of the muscles, sometimes even accompanied by opisthotonos. (See Ann d'Hyg. 1829, ii. 70.) If the individual be sensible, he will commonly suffer the most severe pain, and the pulse may become so quick and irregular that it cannot be counted. When the symptoms are of such a formidable nature, it is very rare that a recovery takes place. The *appearances* met with on making a post-mortem examination of the body are similar to those observed in death from sulphuretted hydrogen. The inspection should be made with caution; for a too frequent respiration of the poisonous exhalations may seriously affect the practitioner. The *treatment* is the same as in poisoning by carbonic acid.

A singular accident occurred in this metropolis in August, 1847, in which a man lost his life by the evolution of a quantity of sulphuretted hydrogen from a foul drain. It appears that shortly before the accident, a large quantity of oil of vitriol had been poured down the drain communicating with the privy. The deceased entered the yard, and was soon afterwards found on the pavement in a dying state. On inspection of the body, the brain was healthy; but the lungs were gorged with blood, which had the offensive odour of sulphuretted hydrogen gas. The medical witness referred death to this gas, and stated that lime had been thrown into the drain, that sulphuret of calcium had probably been formed, and that the sulphuretted hydrogen, which had led to the death of the deceased, had been evolved from this by the vitriol. It is more probable, however, that the gas was evolved by the decomposition of the hydrosulphuret of ammonia, which always abounds in such localities.

The following case, which has a close relation to this subject, occurred in London in 1831:—Twenty-two boys, living at a boarding-school at Clapham, were seized, in the course of three or four hours, with alarming symptoms of violent irritation in the stomach and bowels, spasms of the muscles of the arm,

and excessive prostration of strength. One child, which had been similarly attacked three days before, died in twenty-five hours; and one, among the last attacked, died in twenty-three hours. Both of the bodies were examined after death: in the first, the mucous glands of the intestines were found enlarged, and, as it were, tuberculated. In the second, the mucous coat of the small intestines was found ulcerated, and *that* of the colon softened. At first it was suspected that the boys had been poisoned, but an analysis of the food did not lead to the discovery of any noxious substance. The only circumstance which was considered sufficient to explain the accident was, that *two days* before the first child was seized, a foul cesspool had been opened, and the materials diffused over a garden adjoining the children's playing-ground. This was the opinion expressed by six medical practitioners. (Christison on Poisons, 810.)

Analysis.—The recognition of these gases is a very simple operation. The odour which they possess is sufficient to determine their presence, even when they are diluted with a large quantity of atmospheric air. The *sulphuretted hydrogen gas* is at once identified by its action on paper previously dipped in a soluble salt of lead: if present even in very small proportion, the moistened paper speedily acquires a brownish black stain from sulphuret of lead. The sulphuretted hydrogen may be also thus proved to exist in the vapour of *hydrosulphuret of ammonia* when mixed with air; and the presence of ammonia is indicated in the compound, by the volatile alkaline reaction on test-paper; also by holding in the vessel containing the vapour recently collected a rod dipped in strong muriatic acid: the production of dense white fumes announces the formation of muriate of ammonia. It is a fact, which cannot be too universally known, that a candle will readily burn in a mixture of either of these bodies with air, which, if respired, would suffice to destroy life. (Ann. d'Hyg. 1829, ii. 69.) It is also worthy of remark, that the air of a cesspool may be often respired with safety, until the workmen commence removing the soil, when a large quantity of mephitic vapour may suddenly escape, which will lead to the immediate suffocation of all present. Several persons have been killed by trusting to the burning of a candle, in ignorance of this fact. The best plan for getting rid of the gas is by a free exposure of the locality, or by exciting active combustion in it. According to Parent-Duchâtelet, men can work in an atmosphere containing from two to three per cent. of sulphuretted hydrogen. The air of one of the principal sewers of Paris gave the following results, on analysis, in 100 parts:—oxygen, 13·79; nitrogen, 81·21; carbonic acid, 2·01; sulphuretted hydrogen, 2·99.

Mephitic vapour.—There is another species of deleterious compound present in these exhalations, of a very different nature. It is more rarely met with than the preceding, and consists, in 100 parts, according to Thénard,—of nitrogen, 90; of oxygen, 2, and carbonic acid, 4. Sometimes the carbonic acid gas is combined with ammonia, and then it may be regarded, chiefly, as a mixture of nitrogen holding diffused through it the vapour of carbonate of ammonia, which is sufficient to render it highly irritating to the mucous membrane of the eyes and nose. Its action on the human body, when respired, will be readily understood from this statement of its chemical composition. In its operation it must be regarded as exerting an influence essentially negative; for the small proportion of carbonic acid or of carbonate of ammonia existing in it, cannot be supposed to give rise to the asphyxia which so rapidly follows its inhalation. The chances of recovery are much greater in persons who become asphyxiated from the inspiration of this compound, than in those who are exposed to the influence of the preceding. Commonly the immediate removal to a pure air is sufficient to bring about a recovery; for the asphyxia is originally induced owing to there being an insufficient portion of oxygen in the mixture to sustain life. Should death take place, it will be found, on a post-mortem inspection, that the internal appearances are the same as those which are met with in the examination of the bodies of the hanged or the drowned.

Analysis.—This compound extinguishes a taper: the carbonic acid contained in it may be removed by caustic potash, and then it will be seen that the great bulk of the mixture is formed of nitrogen,—a gas which, by its negative properties, cannot be easily confounded with any other. In a mixed atmosphere of carbonic acid and sulphuretted hydrogen, the two gases may be separated by agitating the mixture with a solution of acetate of lead, and treating the precipitate with acetic acid, which dissolves the carbonate and leaves sulphuret of lead.

EXHALATIONS OF THE DEAD.

It may be proper in this place to make a few remarks on the alleged danger of the exhalations given off by dead bodies in a state of putrefactive decomposition. Formerly there existed a groundless fear relative to the examination of a putrefied dead body; and during the last century, on several important occasions, medical witnesses refused to examine the bodies of deceased persons, who were presumed to have been murdered, alleging that it was an occupation which might be attended with serious consequences to themselves. Orfila has collected many accounts of the fatal effects which are recorded to have followed the removal of the dead some time after interment. (Traité des Exhumations, vol. i. p. 2, et seq.) He allows, however, that the details of most of these cases are exaggerated, and attributes to other causes the effects which followed. Indeed, the observations of Thouret and Fourcroy prove that these dangers are restricted within a very narrow compass, and that in general, with common precautions, the dead may be disinterred and transported from one locality to another, without any risk to those engaged in carrying on the exhumations. About the latter part of the last century, from fifteen to twenty thousand bodies, in almost every stage of decomposition, were removed from the Cimetière des Innocens in Paris; and the accidents that occurred during the operations, which lasted ten months, were, comparatively speaking, few. The workmen acknowledged to Fourcroy, that it was only in removing the recently interred corpses, and those which were not far advanced in decomposition, that they incurred any danger. In these cases, the abdomen appeared to be much distended with gaseous matter,—if ruptured, the rupture commonly took place about the navel, and there issued a bloody fetid liquid, accompanied by the evolution of a mephitic vapour,—probably a mixture of carbonic acid and sulphuretted hydrogen. Those who respired this vapour at the moment of its extrication, fell instantly into a state of asphyxia, and died; while others, who were at a distance, and who consequently respired it in a diluted state, were affected with nausea, vertigo, or syncope, lasting for some hours, and followed by weakness and trembling of the limbs. Chloride of lime was formerly employed for decomposing these vapours; but a strong solution of nitrate of lead, or chloride of zinc, may be substituted for it. Peat charcoal, or the charcoal of oak bark (the refuse of tan-pits,) has also a powerful deodorizing action.

Several lives have been lost of late years from the crowded state of the burial-grounds of London. A deep grave is dug, and this is kept open to be piled with coffins until filled. Persons venturing into these graves are immediately suffocated. The earth in these localities is strongly impregnated with noxious exhalations, and no excavation can be made without its becoming immediately converted into a well of carbonic acid! This appears to be the poisonous gas to which fatal accidents in these localities are most commonly due. (See on this subject Henke's Zeitschrift, 1840, ii. 446; Ann. d'Hyg. 1832, 216; 1840, 131; 1843, 28, 32.)

In addition to these there are other gases of a poisonous nature which are for the most part artificial products. It is seldom that individuals are exposed to respire them in such quantity as to cause serious symptoms or to endanger life. For an account of these, I must refer the reader to my work on POISONS.

LIGHTNING. COLD. STARVATION.

CHAPTER LXIII.

LIGHTNING—EFFECTS OF THE ELECTRIC FLUID—CAUSE OF DEATH—POST-MORTEM APPEARANCES—CASES—LEGAL RELATIONS—COLD—AN OCCASIONAL CAUSE OF DEATH— SYMPTOMS—CIRCUMSTANCES WHICH ACCELERATE DEATH—POST-MORTEM APPEARANCES—CASE OF MURDER BY COLD—STARVATION—A RARE CAUSE OF DEATH—SYMPTOMS—POST-MORTEM APPEARANCES—SUMMARY OF MEDICAL EVIDENCE—LEGAL RELATIONS.

LIGHTNING.

Effects of the electric fluid.—Death by lightning is sufficiently common to require that a medical jurist should be prepared to understand the phenomena which accompany it; but there is a more important reason why he should devote some attention to this subject; this is, that the appearances left by the electric fluid on the human body sometimes closely resemble those produced by extreme mechanical violence. Thus, a person may be found dead in an open field, or on the highway; his body may present the marks of contusion, laceration, or fracture; and to one unacquainted with the fact that such violence occasionally results from the passage of this subtle and invisible agent through the animal system, it might appear that the deceased had been maltreated, and probably murdered. The greater number of deaths from the electric fluid takes place during the spring and summer. According to the annual report of 1838, there were 24 deaths from lightning registered during that year, occurring in the following seasons:—summer, 11; spring, 10; autumn, 2; winter, 1.

Cause of death.—The electric fluid appears to act fatally by producing a violent shock to the brain and nervous system. In general there is no sense of pain—the individual falls at once into a state of unconsciousness. In a case which did not prove fatal, the patient, who was seen soon after the accident, was found labouring under the following symptoms. Insensibility; deep, slow, and interrupted respiration; entire relaxation of the muscular system; the pulse soft and slow; the pupils dilated but sensible to light. (Med. Gaz. xiv. 654.) It will be seen that these are the symptoms of concussion of the brain. The effect of a slight shock is that of producing stunning; and when individuals who have been severely struck recover, they suffer from ringing in the ears, paralysis, and other symptoms of nervous disorder. Insanity has even been known to follow a stroke of lightning. (Conolly's Report of Hanwell, 1839.) In one case the individual remained delirious for three days, and when he recovered he had completely lost his memory. (Lancet, Aug. 3, 1839, 582.) Reaction is best brought about, in cases of slight shocks, by cold affusion.

It may be observed of the effects of lightning generally, that death is either immediate or the individual recovers. A person may, however, linger, and die from the effects of severe lacerations or burns indirectly produced. A case occurred in this city, in July, 1838, where death was thus caused indirectly by the effects of electricity. The following case of recovery illustrates the action of

the electric fluid:—Three persons were struck by lightning at the same time. In one, a healthy man, aged 26, the symptoms were very severe. An hour and a half after the stroke, he lay completely unconscious, as if in a fit of apoplexy;—his pulse was below 60, full and hard, his respiration snoring, his pupils dilated and insensible. There were frequent twitchings of the arms and hands; the thumbs were fixed and immovable, and the jaws firmly clenched. Severe spasms then came on, so that four men could scarcely hold the patient in his bed; and his body was drawn to the left side. When these symptoms had abated, he was copiously bled, cold was applied to the head, and a blister to the nape of the neck, with mustard poultices to the legs. Stimulating enemata and opium were also administered: in the course of twenty-four hours consciousness slowly returned, and the man soon completely recovered. The only external injury discoverable was a red streak as broad as a finger, which extended from the left temple over the neck and chest: this disappeared completely in a few days. (Brit. and For. Med. Rev. Oct. 1842.)

Post-mortem appearances.—Generally speaking, the body, externally, presents marks of contusion and laceration about the spot where the electric current has entered or passed out:—sometimes a severe lacerated wound has existed;—on other occasions there has been no wound or laceration, but a very extensive ecchymosis, which, according to Meyer, is most commonly found on the skin of the back. In one instance which occurred in London in May, 1839, there were no external marks of violence whatever, and several similar cases are quoted from American journals in the Medical Times (May 3, 1845, p. 82.) I have not met with the account of any case where the appearance of a burn has been produced by the direct action of a stroke of lightning; for in those instances in which burns have been found upon the body, it appears that ignition of the clothes or articles of furniture had taken place, to which alone the burning was to be ascribed. The clothes are in almost all cases rent or torn, and partially singed, giving rise to a peculiar odour—sometimes even rolled up in shreds and carried to a distance. Metallic substances about the person present traces of fusion, and articles of steel have been observed to acquire magnetic polarity. Actual ignition of the clothes is far from being a usual attendant on the passage of a current of electricity through the human body. Wounds are sometimes met with on the body. These have commonly been lacerated punctures, like stabs produced by a blunt dagger. In the recent case of an individual who was struck, but not killed, a deep wound was produced in one thigh, almost laying bare the femoral artery. This individual was struck, as many others have been, while in the act of opening an umbrella during a storm. Fractures of the bones have not been commonly observed: in a case mentioned by Pouillet, the skull was severely fractured, and the bones depressed. (Traité de Phys., Elect. Atmosph.)

The following complete account of the external and internal post-mortem appearances found in the body of a healthy middle-aged labourer, who was killed by a stroke of lightning, has been published by Dr. Schaffer. The man was working in the fields with several other labourers, just after a thunder-storm had passed over and had apparently subsided. He was endeavouring to kindle a light with a flint and steel, when the lightning struck him. For a moment after the shock he stood still, and then fell heavily to the ground. The electric fluid entered at the upper part of his forehead, perforating and tearing his hat at that part: it seemed then to have become divided into two currents, which passed down the sides of the trunk, along the lower extremities, and out at the feet. On the upper part of the forehead was found a soft swelling, of a dark blue colour, and about the size of the palm of a hand: the hair which covered it was uninjured. From this spot two dark red streaks proceeded in different directions:—one of these passed to the left, running over the temple, in front of the left ear, down the neck to the surface of the chest, over which it passed between the left nipple and the axilla, and so made its way down the trunk to the left inguinal region,

where it formed a large, irregular, scorched-looking (brandige) patch on the skin. From this point the dark red streak again continued its downward course, passing over the great trochanter, then along the outer surface of the left leg to the back of the foot, where it terminated in several small dark blue spots. The other streak, which proceeded from the ecchymosed swelling on the forehead, passed directly to the right ear, which was considerably swollen and of a dark blue colour:—from the ear it ran downwards, and backwards along the neck, crossed the right border of the scapula, and eventually reached the right groin, where a scorched patch of skin similar to that in the right groin was found. From this part the discoloured streak continued down the outer side of the leg to its termination on the back of the foot, just as on the left side. It is remarkable, that although the hair on the forehead was not burnt, nor that which occurred in any part of the track taken by the electric current down to the groin, yet at the groin itself, and at every part hence to the foot over which the electric stream passed, the hairs were completely burnt. The cause of the skin and hair in the groins being burnt, is probably to be referred to the buckles of a belt which the man wore round his abdomen at the time of the accident: the belt was completely destroyed. Nothing further worthy of notice was observed on the exterior of the body, with the exception of the face being very red. The swelling of the head was found to be due to the presence of a large quantity of extravasated blood. The bone beneath was not injured. Blood was extravasated at other parts of the scalp, corresponding to the swollen discoloured places outside; about four ounces had been effused. The vessels of the cerebral membranes were much congested, and the brain itself contained a large quantity of blood, especially the choroid plexuses. A large quantity of reddish mucus was found in the larynx, trachea, and air-tubes. The lungs were loaded with dark blood; there was a great deficiency of blood in the cavities of the heart and in the large vessels. The blood-vessels of the stomach and intestines were more than usually congested. The right lobe of the liver was of a dark-red colour, and loaded with blood, especially the part which corresponded to the burnt patch of integument at the lower part of the abdomen. The spleen also was large, and loaded with blood. Much blood was found accumulated in the substance of the muscles of the abdomen at those parts which lay beneath the burnt surfaces outside. (Oesterreich. Med. Wochenschrift, 6 Juni, 1846.)

In another case, that of an old man killed by lightning, the external surface of the body presented very slight marks of violence, except the left ear, which was severely lacerated. On opening the head, the left hemisphere of the brain was found entirely disorganized, forming a homogeneous mass, almost liquid, of a grayish colour, and without a vestige of normal structure, except a small portion of the corpus striatum, which had retained its natural appearance and situation. The left lung was partly injured. The skin of the abdomen was marked by black longitudinal superficial lines. On the skin of the left ankle there was an ecchymosed spot, and at the point of the foot a deep wound. The hat and shoes of the deceased had been destroyed, but the rest of his clothes were uninjured. (Heller's Journal, Feb. 1845, 245.)

The following appearances were found in the body of *Professor Richman*, who was killed at St. Petersburgh, in 1753, while engaged in some experiments on atmospheric electrity. On the left side of the forehead, where the deceased had been struck by the electric current, there was a round ecchymosed spot. There were eight other patches of ecchymosis of variable size, extending from the neck to the hip, principally on the left side. Some of these, situated on the trunk, resembled the marks produced by gunpowder, when discharged in contact with the skin. The left shoe was torn open at the buckle without being singed or burnt; but the skin around was slightly ecchymosed. Internally a quantity of blood was found extravasated in the trachea, the lungs, and the layers of the omentum. The omentum presented the appearance of having been violently

contused. (Marbach's Encyklopädie, Blitz.) For a further account of the effects of the electric fluid on the human subject, see Henke, Zeitschrift der S. A. 1844, i. 193.

The blood is said not to become coagulated in the bodies of those who have been killed by lightning, while the muscles of such subjects are described as being constantly in a state of perfect relaxation, and never displaying any appearance of cadaverous rigidity. These statements are not supported by observation. Experiments, carefully performed, have shown that blood through which electric discharges have been transmitted will coagulate as quickly as that which has not been thus treated; and further, Sir C. Scudamore discovered that, on examining the bodies of animals killed by the discharge of a powerful galvanic battery, the blood in the veins was always in a solid state. There is obviously, therefore, nothing in the action of the electric fluid to retard or prevent the coagulation of the blood. With respect to the alleged absence of cadaverous rigidity, there are many circumstances which may accelerate or retard the accession of this state in the dead muscle,—it may take place and disappear quickly, and the subject may not be seen at that particular time by the medical examiner. Sir B. Brodie remarked, that the body of an animal killed by electricity became, as usual, rigid after death. In an accident which occurred in France in August, 1846, a group of labourers was struck by the electric fluid:—four were killed on the spot, and five or six severely wounded. It was remarked that the individual whose body bore the most extensive marks of injury had worn a goat-skin. There were severe lacerations about the body, and in three hours after death it became perfectly rigid. In most of those who were struck, the skin was reddened, but the clothes bore no marks of burning. (Med. Gaz. xxxviii. 351.) In a more recent case communicated to the Medical Gazette by Dr. F. J. Brown, rigidity was strongly marked in the limbs about twenty-eight hours after death. (Vol. xlvii. page 844.) Putrefaction is also said to be hastened in these subjects; but putrefaction is modified by many varying circumstances, and death by lightning usually takes place during summer, when the process is most readily developed. It does not appear that the process takes place more speedily than in sudden or violent death from any other cause. Very few reports have been published of the appearances met with in the body, in cases of death from lightning. The body of a person who has died under these circumstances is seldom examined for a coroner's inquest,—the cause of death being sufficiently obvious without a post-mortem examination.

Legal relations.—Rare as the combination of circumstances must be, in which a medico-legal question can arise in reference to the action of the electric fluid on the body, a case was tried in France, in October, 1845, in which medical evidence respecting the characters of wounds caused by electricity was of considerable importance. In August of that year, some buildings were destroyed at Malaunay near Rouen, as it was alleged, on the one side by a thunder-storm, on the other by a whirlwind; and as the parties were insured against lightning, they brought an action for recovering the amount insured. The evidence in favour of the accident having been due to electricity consisted,—1st, in the alleged carbonized appearance of the leaves of some trees and shrubs growing near; and 2d, in the characters of the wounds on the bodies of several persons who were injured at the time of the occurrence. M. Lesauvage stated at the trial that there was an appearance of dark stains scattered over the bodies, and those who survived suffered from torpor, pains in the limbs, and partial paralysis of motion. He observed also, that decomposition took place very speedily in the bodies of those who were killed. In one instance the muscles were torn and lacerated, and some small arteries divided. This witness attributed most of the wounds to a current of electricity. M. Funel deposed, that in some of the dead bodies which he examined, the face and neck were bloated and discoloured, as if death had taken place from asphyxia. It does not appear, however, that there were

any circumstances decisively proving that the buildings had been destroyed by lightning. M. Pouillet has given an accurate description of the storm: he believed that, although, as deposed to by some of the witnesses at the trial, it may have been attended with thunder and lightning, the buildings with the surrounding trees were overthrown by the mere force of the wind, and not by the electric fluid. The description given bears out this view, but at the same time it is, I believe, a very rare circumstance that trees, when struck, unless old or dry and withered, bear any marks of combustion about the leaves or trunk; and the wounds on a person are not likely to present the characters of burns, unless there are at the same time obvious marks of burning about the clothes. (See Comptes Rendus, Sept. 1845; also, Med. Gaz. xxxvi. 1133.) The scientific evidence was of the most conflicting kind. The Royal Court of Rouen decided that the disaster was occasioned by the atmosphere; and without entering into the various theories of storms, condemned the Insurance Companies to pay the amount claimed. (Law Times, March 14, 1846, 490.)

COLD.

An occasional cause of death.—The protracted exposure of the human body to a very low temperature may become a cause of death; and although in this country cases but rarely occur in which cold alone operates fatally, it is not unusual, during a severe winter, to hear of persons being found dead in exposed situations, and in a state of misery and destitution. On these occasions we may reasonably suspect that the want of proper food and nourishment has accelerated death. It is, however, convenient to make a distinction between the effects of cold and of inanition on the system, as the symptoms preceding death, and the rapidity with which that event takes place, are very different in the two cases.

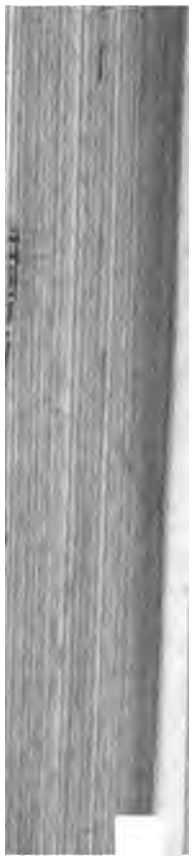
Symptoms.—A moderate degree of cold is well known to have an invigorating effect upon the body; but if the cold be severe, and the exposure to it long continued, while the calorific function is not maintained by warmth of clothing or exercise, the skin becomes pale, and the muscles become gradually stiff and contract with difficulty, especially those of the face and extremities. Sensibility speedily disappears,—a state of torpor ensues, followed by profound sleep from which the person cannot be readily roused: in this state of lethargy the vital functions gradually cease, and the individual finally perishes. Such are the general effects of intense cold on the body. The effect of cold on the nervous system is seen in the numbness, torpor, and somnolency which have been described as consequences of a long exposure to a very low temperature. Giddiness, dimness of sight, tetanus and paralysis, in some cases precede the fatal insensibility which involuntarily steals on the individual. It was observed during the retreat of the French from before Moscow, that those who were most severely affected by cold often reeled about as if in a state of intoxication,—they also complained of vertigo and indistinctness of vision, and sank under a feeling of lassitude into a state of lethargic stupor, from which it was found impossible to rouse them. Sometimes the nervous system was at once affected;—tetanic convulsions, followed by rigidity of the whole of the voluntary muscles, seized the individual, and he rapidly fell a victim. Symptoms indicative of a disturbance of the functions of the brain and nervous system have also been experienced by Arctic travellers during their residence within the Polar circle.

Circumstances which accelerate death.—There are certain conditions which may accelerate death from cold. In all cases where there is exhaustion of the nervous system, as in the aged and infirm,—in those who are worn out by disease or fatigue,—or, lastly, in those who are addicted to the use of intoxicating liquors, the fatal effects of cold are much more rapidly manifested than in others who are healthy and temperate. It has been uniformly remarked, that whenever the nervous energy is impaired either by intoxication or exhaustion from fatigue, the subject falls an easy victim to cold. The exposure of persons in a state of

intoxication during a severe winter, may therefore suffice to destroy life, although the cold might not be so intense as to affect others who were temperate. Casualties of this nature sometimes occur during the winter season in this metropolis; and a knowledge of the influence of intoxication in accelerating death under such circumstances may occasionally serve to remove any doubt in the mind of a practitioner respecting the real cause. Infants, especially when newly born, easily perish from exposure to cold. Cold, when accompanied by rain and sleet, appears to have a more powerfully depressing influence than when the air is dry —probably from the effects of evaporation. The following case by Dr. Currie shows the fatal effects of cold winds accompanied by humidity. "Of several individuals who clung to a wreck, two sat on the only part that was not submerged; of the others, all were constantly immersed in the sea, and most of them up to the shoulders. Three only perished, two of whom were generally out of the sea, but frequently overwhelmed by the surge, and at other times exposed to heavy showers of sleet and snow, and to a high and piercing wind. Of these two, one died after four hours' exposure, the second died three hours later, although a strong healthy adult, and inured to cold and hardship. The third that perished was a weakly man. The remaining eleven, who had been more or less completely submerged, were taken from the wreck the next day, after twenty-three hours' exposure, and recovered. The person among the whole who seemed to have suffered least was a negro: of the other survivors, several were by no means strong men, and most of them had been inured to the warm climate of Carolina."

Post-mortem appearances.—Opportunities rarely occur of examining bodies, when death results purely from exposure to cold. The surface is commonly pallid, and the viscera of the chest and abdomen as well as the brain are congested with blood. Dr. Kellie, of Leith, found in two cases, which he examined, a redness of the small intestines from turgescence of the capillary vessels, and a great effusion into the ventricles of the brain. A sufficient number of cases have not yet been inspected to enable us to determine how far these two last-mentioned appearances are to be regarded as consequences of death from cold; but all observers have found a general congestion of the vascular system internally. In consequence of the great turgescence uniformly met with in the vessels and sinuses of the brain, some pathologists have regarded death from cold as resulting from an attack of apoplexy; but the symptoms which precede death do not bear out this view. Extravasations of blood have not been observed, and a mere fulness of the cerebral vessels after death is not in itself sufficient to justify this opinion. It will be observed, that on the whole these appearances are remarkably similar to those which are found in death from severe burns and scalds. Thus, then, the medical jurist will perceive, that to come to a decision whether, on the discovery of a dead body, death has taken place from cold or not, is a task of great difficulty. The season of the year,—the place and circumstances under which the deceased is found,—together with the absence of all other possible causes of death (such as from violent injuries or internal disease,) form the only basis for a medical opinion. Death from cold is not to be determined except by negative or presumptive evidence, for there is no organic change, either externally or internally, sufficiently characteristic of it to enable us to decide positively on the subject.

Case of murder by cold.—The following is a singular medico-legal case, involving the question of the fatal effects of cold upon the body. A man and his wife, residing at Lyons, were tried for the murder of their daughter, a girl aged eleven, under the following circumstances:—On the 28th of December, at a time when there was a severe degree of cold, the female prisoner compelled the deceased to get out of her bed, and place herself in a vessel of ice-cold water. The child cried, and endeavoured to escape from the bath, but she was by violence compelled to remain in the water. The deceased complained of exhaustion



without risk provided the skin be kept warm.

STARVATION.

A rare cause of death.—Death from the mere privation of rare event, although, if we were to form an opinion from ners' juries, its occurrence would not appear to be very unc other large and populous cities. In the Registration Retu stated that 130 persons died from starvation. Such case received with some distrust, as care is rarely taken to ascert bodily disease may have been concerned in the death of the not be denied that starvation should be classed among the ca being sometimes the result of criminal neglect or inattentior children or of infirm and decrepit persons, and thus consti at other times, although very rarely, arising from an obstin commit suicide in those from whom all other means of sel off. [This mode of committing suicide is not so very rare is very apt to succeed, sooner or later, in spite of the best en of the medical attendants and the most experienced nurses. several cases in this city, nearly all of which terminated most cases, probably, some form of dyspepsia, which keeps in regard to food or the aversion to it.—H.]

Symptoms.—The symptoms which attend on protracted described by Rostan:—In the first instance, pain is felt which is relieved by pressure. The countenance becomes pa the eyes become wild and glistening,—the breath hot,— parched. An intolerable thirst supervenes, which, in all ca cide by starvation, has formed the most prominent symptom emaciated, the eyes and cheek sink, and the prominences o ceptible: the feeling of pain is often so intense as to give ri There is the most complete prostration of strength, which re incapable of the least exertion. After a longer or shorter hales a fetid odour, the mucous membrane of the outlets be and inflamed, and life is commonly terminated by a fit of n

cretion poured out from the exhalants on the surface of the body. The sufferer tottered in walking, like a drunken man; his voice became weak, like that of a person in cholera; he whined like a child, and burst into tears on the slightest occasion. In respect to the mental faculties, their prostration kept pace with the general wreck of bodily power; in many there was a state of imbecility; in some, almost complete idiotism; but in no instance was there delirium or mania, which is often described as a consequence of protracted abstinence among shipwrecked mariners. (Dub. Med. Press, February, 1848, 67.)

Period of death.—The period which it requires for an individual to perish from hunger is subject to variation. It will depend materially upon the fact, whether a person has it in his power or not to take at intervals a portion of liquid to relieve the overpowering thirst which is commonly experienced. The smallest portion of liquid thus taken occasionally, is found to be capable of prolonging life. It is probable that in a healthy subject under perfect abstinence, death would not commonly take place in a shorter period than a week or ten days. This opinion appears to derive support from the results of those cases in which there has been abstinence owing to disease about the organs of deglutition.

Post-mortem appearances.—There are no very satisfactory details of the appearances presented by the bodies of those who have died of inanition, and the cases themselves are too rare to enable us to decide with certainty upon the accuracy of the reports which have hitherto appeared on the subject. The body has been found much emaciated, the skin dry, and the stomach and intestines contracted and empty, the mucous membrane sometimes ulcerated; the gall-bladder much distended with bile; the lungs, heart, and great vessels connected with these organs, collapsed and destitute of blood. The following account of the appearances met with in a fatal case of starvation has been published by Dr. Sloan, of Ayr. A healthy man, aged 65, was by an accident shut up in a coal-mine twenty-three days. For the first ten days he was able to procure and swallow a small quantity of foul water. When found, he could not make the least exertion, nor could he speak above a whisper. Attempts were made to recover him, but he died in three days, perfectly exhausted. On inspection, the body was observed to be extremely emaciated; the intestines were collapsed, the stomach was distended with air, and slightly reddened at its cardiac extremity. The liver was small, and the gall-bladder distended. The other viscera were in their normal state. (Med. Gaz. xvii. 389.) Mr. Tompkins, of Yeovil, inspected the body of a man who died from starvation in February, 1838. The face was much shrunk and emaciated; the eyes open, and presenting a fiery red appearance, as intense as in a case of acute ophthalmia during life. This red appearance has been met with by Dr. Donovan in death from exposure to cold. (Dub. Med. Press, Feb. 2, 1848, p. 66.) The skin was tough, and there was scarcely any cellular membrane to be seen. The tongue, lips, and fauces, were dry and rough. A peculiar odour exhaled from the body. The lungs were shrunk and contracted; the pleura was slightly inflamed. The stomach and intestines were empty, but quite healthy; the gall-bladder was nearly full of bile, and the surrounding parts were much tinged by this liquid. The urinary bladder was empty and contracted. (Lancet, March, 1838.) In some cases inspected during the Irish famine, Dr. Donovan states that the appearances which he witnessed were extreme emaciation, total absorption of the fatty matter on the surface of the body, total disappearance of the omentum, and a peculiarly thin condition of the small intestines, which, in such cases, were so transparent, that if the deceased had taken any food immediately before death, the contents could be seen through the coats of the bowel: on one occasion (at an inquest,) he was able to recognise a portion of raw green cabbage in the duodneum of a man who had died of inanition. This condition of the coats of the intestines he looks upon as the strongest proof of starvation. The gall-bladder was usually full, and the parts in the vicinity of it were much tinged from the cadaveric exudation of bile; the urinary

bladder was generally contracted and empty, and the heart pale, soft, and flabby: there was no abnormal appearance in the brain or lungs.

Summary of medical evidence.—These appearances, in order to throw any light upon the cause of death, should be accompanied by an otherwise healthy state of the body; since, as it is well known, they may be produced by many organic diseases, and death may be thus due to disease, and not to the mere privation of food. It will not, therefore, be easy to say whether the emaciation depend on disease or want of food, unless we are put in possession of the history of the case. On this account, in all charges of homicidal starvation, the defence generally turns upon the co-existence of disease in the body, and the sufficiency of this to account for death. In some of these alleged deaths by starvation, ulceration of the bowels is met with. This has been considered to arise from want of food, but Dr. Donovan did not meet with it in those who died of lingering starvation. (Dublin Med. Press, Feb. 2, 1848, 66.) See, in reference to medical evidence, the case of The *Queen* v. *Pryke*, Chelmsford Summer Ass. 1840.

Legal relations.—Starvation is commonly the result of *accident* or *homicide;* but this is a question purely for the decision of a jury; it cannot be elucidated by medical evidence. The withholding of food from an infant forms a case of homicide by starvation, on which a medical opinion may be occasionally required. Mr. Baron Gurney held that the *mother* and not the father was bound to supply sustenance to an infant. The child in this case was ten weeks old, and the father was charged with wilful murder, on the ground that he had not supplied it with food. The grand jury ignored the bill under the instructions of the judge, upon the ground above stated. (The *King* v. *Davey*, Exeter Lent Ass. 1835.) But where the husband and wife were charged with the murder of an apprentice to the husband, by using him in a barbarous manner, and the opinion of the medical witness was, that the boy had died from debility occasioned by the want of proper nourishment, it was held that the wife was entitled to be acquitted, as it was the duty of the *husband*, and not of the wife, to provide sufficient food and nourishment for the apprentice. (The *King* v. *Squire*, Starkie, ii. 947.) Starvation is rare as an act of homicide, but it must not be supposed that the law implies by this the absolute privation of food; for if that which is furnished to a person be insufficient in quantity, or of *improper quality*, and death be a consequence, malice being at the same time proved, then the offender equally subjects himself to a charge of murder. Not many years since, a woman who was accustomed to take parish-apprentices, was tried and convicted of the murder of two children, who had died in consequence of the bad quality and small quantity of food furnished to them by the prisoner.

INSANITY.

CHAPTER LXIV.

LEGAL DEFINITIONS—LUNACY—NON COMPOS MENTIS—UNSOUNDNESS OF MIND—VARIETIES OF INSANITY—MANIA—HALLUCINATIONS—ILLUSION—DELUSION—MANIA DISTINGUISHED FROM DELIRIUM—MONOMANIA—KNOWN FROM ECCENTRICITY—MORAL INSANITY—DEMENTIA—IDIOCY—IMBECILITY—POST-MORTEM APPEARANCES—HEREDITARY TRANSMISSION—FEIGNED INSANITY—MODE OF DETECTION.

Legal definitions.—The law of England recognises two states of mental disorder or alienation. 1. *Dementia naturalis*, corresponding to idiocy; and 2. *Dementia adventitia*, or *accidentalis*, signifying general insanity, as it occurs in individuals who have once enjoyed reasoning power. To this state the term lunacy is also applied, from an influence formerly supposed to be exercised by the moon on the mind. *Lunacy* is a term generally applied by lawyers to all those disordered states of mind which are known to medical men under the names of mania, monomania, and dementia; and which are generally, though not necessarily, accompanied by lucid intervals. The main character of insanity, in a legal view, is said to be the existence of *delusion; i. e.* that a person should believe something to exist which does not exist, and that he should act upon this belief. Many persons may labour under harmless delusions, and still be fitted for their social duties; but should these delusions be such as to lead them to injure themselves or others in person or property, then the case is considered to require legal interference.

Unsoundness of mind.—Besides the terms *Idiocy* and *Lunacy*, we find another frequently employed in legal proceedings, namely, "*unsound mind*"—(*non compos mentis*)—of the exact meaning of which it is impossible to give a consistent definition. From various legal decisions, it would appear that the test for unsoundness of mind in law has no immediate reference to the mere existence of delusion, so much as to proof of incapacity in the person, from some morbid condition of intellect, to manage his own affairs. (Amos.) Neither condition will suffice to establish unsoundness without the other; for the intellect may be in a morbid state, and yet there may be no legal incompetency, or the incompetency alone may exist, and depend on bodily infirmity or want of education—a condition which must not be confounded with insanity. Thus, then, a person may be of unsound mind, *i. e.* legally incompetent to the control of his property, and yet not come up to the strict legal standard of lunacy or idiocy. Hence it will be seen that it is impossible, in medical jurisprudence, to give any consistent definition of insanity. A medical witness who ventures upon a definition, will generally find himself involved in numerous inconsistencies. No words can possibly comprise the variable characters which this malady is liable to assume. The power which is most manifestly deficient in the insane is generally the controlling power of the will.

Some medical practitioners have attempted to draw a distinction between *in-*

sanity and *unsoundness* of mind. A case occurred in 1839, in which a medical man hesitated to sign a certificate for the confinement of an alleged lunatic, because in it the terms "unsound mind" were used. He said he would not have hesitated to sign it had the term "insane" been substituted. The difference, if any exist, is purely arbitrary, and depends on the fact, that unsound mind is a legal and not a medical phrase, referring to an incapacity to manage affairs, which insanity, in its most enlarged sense, may not always imply. The law, however, appears to admit some sort of distinction: for, according to Chitty, it is a criminal and an indictable act maliciously to publish that any person is afflicted with insanity, since it imputes to the party a malady generally inducing mankind to shun his society; although it is not libellous to say that a man is not of sound mind, because no one is of perfectly sound mind but the Deity! (M. J. i. 351.) In reference to the refusal to sign certificates, it is, however, an error to suppose that the use of one term can involve a practitioner in a greater share of responsibility than the use of the other.

Varieties of insanity.—Medical jurists have commonly treated insanity under four distinct forms: *Mania, Monomania, Dementia* and *Idiocy (Amentia.)* This division was proposed by Esquirol, and although of a purely artificial nature, it is highly convenient for the arrangement and classification of the facts connected with the subject. In some instances there is great difficulty in assigning a particular case to either of these divisions, which is owing to the circumstance, that these states of mind are frequently intermixed, and are apt to pass and repass into each other. On other occasions a case may present characters which appertain to all the divisions. Some psychologists have proposed two subdivisions, namely, *Incoherency* and *Imbecility;* but the former is merely a mixed state of mania and dementia, while the latter is a term applied to those cases of idiocy wherein the mental faculties are susceptible of cultivation after birth, without reaching the normal standard. In a work on Medical Jurisprudence, it will be only necessary to state briefly the principal features of each of these varieties of insanity.

Mania.—In this form of insanity there is a general derangement of the mental faculties, accompanied by greater or less excitement, sometimes amounting to violent fury. The individual is subject to hallucinations and illusions, the difference in the meaning of which terms it may here be proper to explain. *Hallucinations* are those sensations which are supposed by the patient to be produced by external impressions, although no material objects may act upon the senses at the time. (See on this subject remarks by Dr. Sigmond, Journal of Psychol. Med. 1848, p. 585.) *Illusions* are sensations produced by the false perception of objects. (Marc.) When a man fancies he hears voices, while there is profound silence, he labours under a hallucination: when another imagines that his ordinary food has an earthy or metallic taste, this is an illusion. Illusions sometimes arise from internal sensations, and give rise to the most singular ideas. When a hallucination or an illusion is believed to have a real and positive existence, and this belief is not removed either by reflection or an appeal to the other senses, the individual is said to labour under a *delusion;* but when the false sensation is immediately detected, and is not acted on as if it were real, then the person is sane. Perhaps this is the most striking distinction which it is in our power to draw between sanity and insanity. The acts of the insane are generally connected with their delusions; but it is extremely difficult to trace the connexion between them except by their own confession. It has been remarked, that in mania there is great insensibility to changes of temperature; but it must not be inferred from this that the patient is less susceptible than a sane person of the injurious effects of cold. The bodily susceptibility of insane persons is just as great, while they want that warning power which the sense of feeling gives to one who is sane. It is necessary that a medical jurist should

be able to distinguish *mania* from delirium depending on bodily disease. *Delirium* very closely resembles the acute form of mania,—so closely that mistakes have occurred, and persons labouring under it have been improperly ordered into confinement as maniacs. The following are perhaps the best diagnostic differences. A disordered state of the mind is the first symptom remarked in mania; while delirium is a result of bodily disease, and there is greater febrile excitement in it than in mania. Delirium, being a mere symptom attendant on the disease which produces it, exists so long as that disease, and no longer; while mania, depending on very different causes, is persistent. Delirium disappears suddenly, leaving the mind clear; while mania commonly experiences only remissions. (See Pagan, M. J. of Ins. 69.)

Monomania.—This name is applied to that form of insanity in which the mental alienation is partial. The delusion is said to be confined either to one subject or to one class of subjects. One fact is well ascertained, that monomania varies much in degree; for many persons affected with it are able to direct their minds with reason and propriety to the performance of their social duties, so long as these do not involve any of the subjects of their delusions. Further, they have occasionally an extraordinary power of controlling their thoughts and emotions, as well as of concealing the delusions under which they labour. This implies a consciousness of their condition not met with in mania; and it also appears to imply such a power of self-control over their thoughts and actions, as to render them equally responsible with a sane person for many of their acts. In a real case of monomania, it is not to be supposed that a man is insane upon *one* point only, and sane upon all other matters. The only admissible view of this disorder is that which was taken by Lord Lyndhurst, in one of his judgments. In monomania, the mind is unsound; not unsound in one point only, and sound in all other respects, but this unsoundness manifests itself principally with reference to some particular object or person. (Prichard.) There is no doubt that all the mental faculties are more or less affected: but the affection is more strikingly manifested in some than in others. Monomania is very liable to be confounded with *eccentricity:* but there is this difference between them. In monomania, there is obviously a change of character,—the individual is different to what he was: in eccentricity, such a difference is not remarked; he is, and always has been, singular in his ideas and actions. An eccentric man may be convinced that what he is doing is absurd and contrary to the general rules of society, but he professes to set these at defiance. A true monomaniac cannot be convinced of his error, and he thinks that his acts are consistent with reason and the general conduct of mankind. In eccentricity there is the will to do or not to do: in real monomania the controlling power of the will is lost. Eccentric habits suddenly acquired are, however, presumptive of insanity. It will be seen hereafter that the diagnosis of these states is of considerable importance in relation to the testamentary capacity of individuals.

Most medico-legal writers admit that insanity is not necessarily confined to the *intellectual* powers; but that it may also show itself without decided intellectual aberration in the feelings, passions, and emotions. Thus it may appear under the form of a causeless suspicion, jealousy, or hatred of others, especially of those to whom the individual ought to be attached; and it may also manifest itself under the form of a wild, reckless, and cruel disposition. This is what has been called by Dr. Prichard "*Moral insanity*," to distinguish it from the other form affecting the mental powers, namely, "*Intellectual insanity*." It is, however, very doubtful whether moral insanity ever exists in any individual without greater or less disturbance of the intellectual faculties. The mental powers are rarely disordered without the moral feelings partaking of the disorder: and conversely; it is not to be expected that the moral feelings should become to any extent perverted without affecting the intellect. The intellectual disturbance may be very difficult of detection; but in every case of true insanity it is more or less present, and it would probably be a dangerous rule to pronounce a man insane, when some

evidence of its existence was not forthcoming. The law hesitates at present to recognise moral insanity, at least in civil cases: hence, however perverted the affections may be, a medical jurist must look for some indications of *intellectual* disturbance. Monomania may be accompanied with a propensity to homicide or suicide, and according to many psychologists, with a disposition to incendiarism or theft. These forms will be referred to hereafter, in speaking of the criminal responsibility of the insane.

Dementia.—In this state there is a total absence of all reasoning power;—the mental faculties are not perverted, but destroyed. There is a want of memory as well as a want of consciousness on the part of the individual, of what he does or says. It is by no means an unfrequent consequence of mania or monomania,—but it has been known to occur suddenly in individuals, as an effect of a strong moral shock.

Idiocy. Amentia.—Idiocy is characterized by the want of mental power being congenital. While mania, monomania, and dementia, form the "*dementia accidentalis*,"—idiocy forms the "*dementia naturalis*" of lawyers. This intellectual deficiency is marked by a peculiar physiognomy, an absence of all expression, and a vague and unmeaning look, whereby an idiot may in general be clearly identified. In many cases of congenital deficiency, the mind is capable of receiving a few ideas, and of profiting to a certain extent by instruction. To this state the term *Imbecility* is applied. It may be regarded as a minor degree of idiocy. The mind of an imbecile can never be brought to a healthy standard of intellect, like that of an ordinary person of the same age. The degree to which congenital deficiency of intellect exists is generally well marked by the power of speech, or of communicating ideas by language. In idiocy there is no speech, or only an utterance of single words:—in the better class of imbeciles, the speech is but little affected; while there is every grade between these two extremes. Some medical jurists have arranged imbeciles in classes, according to their capacity to receive instruction; others, according to their power of speech: but such divisions are practically without value,—each case must be judged by itself. It is by no means easy to draw a distinction between the better classes of imbeciles, and those who are ruptured sane,—since the minds of sane persons differ remarkably in their capacity to receive instruction. It has been well observed, that by endeavouring to make a very close distinction of this kind, one half of the world might reason itself into the right of confining the other half as insane! Persons affected with idiocy and imbecility do not suffer from hallucinations and illusions, like those who labour under mania or monomania. Idiots and imbeciles are what they always have been: there is no gradual loss or impairment of the intellectual functions. The term imbecility is often applied to that loss of mental power which takes place as a result of extreme age: but this is with greater propriety called *senile dementia.*

Such are the forms under which insanity or mental alienation presents itself to our notice. This classification has been adopted for the sake of convenience; because by it a practitioner may be led to form a safe diagnosis of the real state of mind of a person. It is not recognised in any of the law-proceedings connected with the insane:—for in these the term *unsoundness of mind*, comprehending lunacy and idiocy, is almost exclusively employed. In adopting this arrangement, a medical jurist must take care not to fall into an error which has been sometimes committed, *i. e.* of pronouncing a person to be of sound mind, because his case could not be easily placed in any one of these four great divisions of insanity. This would be as serious an error as that formerly committed by some law-writers,—namely, of giving restricted and incorrect definitions of lunacy and idiocy, and then contending that, whoever was not a lunatic or idiot according to these arbitrary legal definitions, must be a person of sound mind!

Post-mortem appearances.—In some cases a medical practitioner may be required to state whether certain appearances found in the brain of a deceased

person do or do not indicate the past existence of a certain degree of insanity or imbecility? Such a question is only likely to arise in chronic cases, in which the insanity from oral testimony may be disputed. (Case of *Stulz*, Prerog. Court, 1852.) The appearances commonly met with on an inspection are thickening of the bones of the skull, close adhesions of the dura mater (the lining membrane,) with great congestion of the pia mater, and opacity and thickening of the arachnoid membrane. There is general fulness of the blood-vessels of the brain, with remains of cysts, hardened deposits, or even abscesses in various parts of the substance of the brain. Inferences from the existence of these changes in the brain must be drawn with caution, because it cannot be said that they necessarily indicate insanity; nevertheless, such chronic changes in the brain must be considered as producing greater or less derangement of the mental functions; but the actual degree to which the impairment has existed ought properly to be determined by evidence of the conduct and actions of the deceased during life. The reader will find some valuable information on this subject in a paper by Mr. Fisher (Med. Gaz. xxxvii. p. 657;) and in another by Mr. Eccleston (Med. Gaz. xlvii. p. 170;) also in some contributions to the Journal of Psychological Medicine (1850, p. 521, and 1851, pp. 236 and 383,) by Mr. Holmes Coote. See also Dr. Jamieson's Lectures, Med. Gaz. xlvi. p. 652; and a paper by Dr. Webster, Journal of Psychol. Med. 1849, p. 483; by Dr. Farre, in same volume, p. 534; and by Dr. Hitchman, in the volume for 1850, pp. 228, 362, 501.

Hereditary transmission.—The hereditary transmission of the malady has sometimes presented itself as a medico-legal question in relation to the criminal responsibility of the insane. According to Chitty, it is an established rule of law, "that proof that other members of the same family have decidedly been insane is not admissible either in civil or criminal cases." (Med. Jur. i. 352.) But recent decisions have shown that this statement is not correct. In the case of *Reg.* v. *Ross Touchet*, 1844, tried and acquitted on the ground of insanity for shooting a man, Maule, J. held that evidence that the grandfather had been insane may be adduced, after it has been proved by medical testimony that such a disease is often hereditary in a family. It was also admitted in *Oxford's* case,—the prisoner having been here tried for shooting at the Queen. (Law Times, Oct. 26, 1844.) This kind of evidence has, however, been frequently rejected, and it is not admitted in the law of Scotland. (*Gibson's* case, Edinburgh, Dec. 1844.) There can be no doubt, from the concurrent testimony of all writers on insanity, that a predisposition to the disease is frequently transmitted from parent to child through many generations. The malady may not always show itself in such cases, because the offspring may pass through life without being exposed to any exciting cause; but in general it readily supervenes from very slight causes. M. Esquirol has remarked, that this hereditary taint is the most common of all the causes to which insanity can be referred, more especially as it exists among the higher classes of society. Among the poor, about one-sixth of all the cases may be traced to hereditary transmission; and other authorities have asserted that in more than one half of all cases of insanity, no other cause can be found for the malady. As we might suppose, children which are born before insanity manifests itself in the parents are less subject to the disorder than those which are born afterwards. When one parent only is insane, there is less tendency for the predisposition to be transmitted than when both are affected: but according to Esquirol, this predisposition is much more readily transmitted through the female than through the male parent. Its transmission is also more strikingly remarked when it has been observed to exist in several generations of lineal ancestors; and, like other hereditary maladies, it appears to be subject to atavism; *i. e.* it may disappear in one generation, and reappear in the next. Further, the children of drunken parents, and of those who have been married late in life, are said to be more subject to insanity than those born under other circumstances. When insanity is transmitted by hereditary descent, it appears often about the

same age, under the same form, and is induced by the same exciting cause in the offspring as in the parent. This it is proper for a medical jurist to bear in mind, in examining a plea of insanity in criminal cases. (See Journal of Psychol. Med. 1848, p. 264.)

Statistics.—The valuable tables of Esquirol shows that the age at which insanity most commonly attacks persons is thirty:—it rarely makes its appearance below the age of twenty, or above the age of fifty-five. According to a Report published by the Commissioners of Lunacy for 1850, there were in that year under their supervision in England and Wales, 15079 lunatics, namely, 7074 males, and 8005 females. Of these, 11305 belonged to the pauper class; and of the whole number 7140 were confined in asylums. Dr. Jamieson has published in his lectures some curious facts regarding the statistics of insanity, to which I must refer the reader (Med. Gaz. xlvi. p. 269;) and an able analysis of the Commissioners' Report will be found in the Journal of Psychol. Med. 1850, p. 111.

Feigned insanity.—Insanity is frequently feigned by persons accused of criminal offences, in order to procure an acquittal or discharge. In the first place, when this is suspected, it will be proper to inquire whether the party have any *motive* for feigning the malady. It is necessary to remember that insanity is never assumed until *after* the commission of a crime and the actual detection of the criminal. No one feigns insanity merely to avoid suspicion. In general, as in most cases of imposture, the part is over acted—the person does too much or too little, and he betrays himself by inconsistencies of conduct and language which are never met with in real cases of insanity. There is commonly some probable cause to which real insanity may be traced, but when the malady is feigned, there is no apparent cause:—in this case the appearance of the assumed insanity is always sudden:—in the real malady, the progress of an attack is generally gradual, and when the attack is really sudden, then it will be found to be due to some great moral shock or other very obvious cause. We should observe whether there has been any marked change of character in the individual, or whether his conduct, when he had no interest to feign, was such as it is now observed to be. Some difficulty may arise when fits of eccentricity or strangeness of character are deposed to by witnesses; but these statements may be inconsistent with each other, and the previous acts of the person may bear no resemblance whatever to those performed by him in the recently assumed condition. A difficulty of this kind rarely presents itself, since in an imposter, no act indicative of insanity can be adduced for any antecedent period of his life: it is only *after* the perpetration of a crime and its detection, that any action approaching to insane habits will be met with. In real insanity, the person will *not* admit that he is insane:—in the feigned state, all his attempts are directed to make you believe that he is mad; and an imposter may be induced to perform any act, if it be casually observed to another in his presence that the performance of such an act will furnish strong evidence of his insanity.

Mania is perhaps more frequently assumed than any other form, because the vulgar notion of insanity is, that it is made up of violent action and vociferous and incoherent language: but mania rarely comes on suddenly, or without an obvious cause:—the patient is also equally furious day and night, while the imposter is obliged to rest after his violent exertions. Dr. Burrows recommends that close attention should be paid to the expression of the eye. The mobility of the features may be as rapid as the imagination is vivid; but when every feature may vary, or be kept under control and be steady, the eye will still indicate the erring thought. Its expression cannot be easily assumed. In mania the person sleeps but little, and the sleep is disturbed:—an imposter sleeps as soundly as a healthy individual:—the violence of the maniac continues whether he is alone or not, while the imposter acts his part only when he thinks he is observed: hence the imposition may be detected by watching him, when he is not aware that an eye is directed upon him.

Some stress has been laid on the fact, that assumed insanity commonly appears suddenly and without probable cause; but while this may be allowed to have a general value in forming a diagnosis, it is proper to bear in mind that the actual commission of a crime has sometimes suddenly led to an attack of mania in a previously sane person. Dr. Pagan has related a very singular instance of this kind. Two men were committed to prison on a charge of theft, and the officers requested a poor man, who was a shoemaker, to assist them in conveying the prisoners. The man took a gun with him for better security. During the journey, one of the prisoners leaped from the cart and ran off. The officers called to their assistant to fire, and he thinking himself warranted to do so, fired, and wounded the prisoner severely in the back and loins. The man who fired the gun was himself immediately committed to gaol as a criminal, and the event made such an impression upon him that he became violently maniacal. When scarcely recovered, he was tried for the offence; and it was supposed that he was feigning insanity. He was convicted and sentenced to six months' imprisonment. (Med. Jur. of Ins. 82.) This case proves that a person may really be attacked by mania under circumstances in which justifiable suspicion might arise that he was feigning.

The feigning of monomania would be a matter of some difficulty, and easily susceptible of detection. Dementia is more easily feigned:—in general this state comes on slowly, and is obviously dependent on organic changes, as old age, apoplexy, paralysis or hemiplegia, or it is a consequence of long-continued mania or monomania. As this form of insanity consists in an entire abolition of all mental power, so the discovery of any connected ideas, reasoning or reflection, either by language or gestures, would at once show that the case was not one of real dementia. Idiocy and imbecility could hardly be feigned successfully, because these are states of congenital deficiency; and it would be easy to show, by reference to the past life of a person, whether he had or had not always been such as he represents himself. The difficult cases of feigned insanity are really limited to those forms of the malady which are liable to attack an individual suddenly. In a sudden attack of real insanity, there should be some obvious cause:—the non-existence of this, with the presence of a strong motive for deception, will always justify a suspicion that the malady has been assumed.

The following is a case of feigned insanity which was the subject of a trial in London, in 1833. A married woman, aged fifty, was charged with uttering a forged cheque:—she had craftily procured the signature of a person under a false pretence, and then forged his name to the cheque. When required to plead, she made no answer and appeared unconscious of the question. She took up some flowers placed in the dock, and crumbled them in her fingers, which were in continual motion. She stared wildly at times, changing her position,—turned her back on the court,—muttered indistinct exclamations, and made a humming noise. She was placed under some restraint in order to prevent her from jumping out of the dock. The first question which the jury was directed to try, was whether she was of "sound mind or not,"—it being a rule of law that no insane person can be called on to plead to an offence committed by him. Evidence was then adduced to show, that at previous periods of her life she had used incoherent language and was strange in her conduct. It was also shown that her mother, aunt, and sister, had been insane. Dr. Uwins deposed that at first he thought the prisoner was feigning, for she appeared to be fully aware of the importance of the plea of insanity, but when he heard that other members of her family had had the disease, he was induced to think her insane, and not accountable for her actions. Another medical witness, who had attended her family professionally, and had known the prisoner long, thought she was not insane, although he allowed that the apprehension of a criminal charge might bring on an attack of insanity in a mind subject to aberration. Other witnesses deposed that they had never observed any acts of insanity about her; and it was

further proved that she was well acquainted with the method of drawing and procuring money on bills. When arrested, she tried to escape from the officer, and conceal the money which she had procured by means of the forged cheque. The surgeon of the gaol thought she was feigning: he visited her daily, and he observed that her manner was changed so soon as she saw him. When asked what counsel she would employ, she returned a rational answer, saying that "others would take care of that:"—when charged with feigning, she made no observation. She put on a wild look when she knew that she was observed; but when privately watched, her behaviour was that of a rational person:—she generally slept soundly. The jury returned that she was of sound mind. She was then called on to plead to the charge, but she refused,—a circumstance rarely observed in the conduct of a really insane person. She was tried, and found guilty of the charge. There could be no reasonable doubt that this woman was an impostress, and that she feigned insanity, well knowing what would be the result of the plea, if admitted. Two circumstances rather tended to complicate the case: 1. The proof of hereditary predisposition: 2. Her assumed silence, whereby she did not easily betray herself. In regard to hereditary predisposition, although valuable as collateral evidence, it cannot, of course, be allowed to outweigh general facts indicative of perfect sanity. For a singular case in which a verdict was returned against strong medical evidence of alleged insanity, see Lancet, January 18, 1845, p. 70: also, Ann. d'Hyg. 1829, ii. 367, 376, and a case by Dr. Bayard, Ann. d'Hyg. 1847, ii. 230. (See also another case, Med. Gaz. xlvii. p. 49, and a paper in Journ. Psychol. Med. 1848, p. 277.)

CHAPTER LXV.

MEDICO-LEGAL QUESTIONS IN RELATION TO THE INSANE—IMPOSITION OF RESTRAINT—ILLEGAL IMPOSITION OF RESTRAINT—VIOLENCE OF TEMPER—CERTIFICATES OF INSANITY—RULES FOR THE DISCHARGE OF LUNATICS.

Medico-legal questions.—Among the questions which may come before a medical jurist, in relation to the subject of insanity, are the following:—A practitioner may be required to say whether a person affected with the malady should or should not be confined in a lunatic asylum,—whether he should be deprived of his civil rights by interdiction, or whether he be so completely cured of his malady, as to justify his liberation from confinement. Then, again, medical evidence may go far to determine whether a will or deed, executed by an alleged lunatic, should be set aside; whether a marriage contract should be annulled; and lastly, whether a criminal act was committed by a person labouring under insanity,—a question involving either the life, or, according to circumstances, the perpetual imprisonment of an accused party.

Imposition of restraint.—By this we are to understand the separation of a lunatic from his friends or relatives with or without the confinement of his person by force. What are the circumstances which will justify a practitioner in applying restraint to the insane? The law has given great power in this respect to members of the medical profession, but owing to certain abuses, this power has been of late years much restricted by various acts of the legislature. Most medico-legal writers agree, that we are never justified in ordering restraint, except when from the symptoms we have reason to apprehend that the lunatic will injure his person or property, or the persons or property of others. It is then not sufficient to seek merely for evidence of *delusion;* but if we discover that the individual labours under some delusion, it is our duty to consider how far this

may prospectively endanger the well being of himself and his friends. Unless the delusion be such as to render it probable that his own interests or those of others may be damaged by his insane conduct, careful and judicious superintendence will answer all the purposes of the closest restraint. (For some remarks on this subject, see Med. Gaz. xliv. p. 1061.) Some have justified the act of resorting to restraint on all occasions, on the principle that it may tend to the cure of a patient by removing the delusion. In this point of view the subject has no relation to legal medicine. It may be urged with more plausibility, that by withholding restraint in incipient cases, mischief may be done by the lunatic to himself or others, and that then it will be too late to interfere; but even here proper superintendence will render close confinement unnecessary. A medical practitioner must not be too ready to lend himself to the signing of certificates for the imprisonment of persons who may be labouring under harmless delusions. In violent mania, or in monomania with a homicidal or a suicidal propensity, there can be no doubt of the propriety of applying some degree of restraint, for here the necessity is imminent. If a remarkable change has suddenly taken place in the character of the patient; if he has become irritable, outrageous, or threatened personal violence to any one, or if he has recklessly endangered the interests of himself and family, he is undoubtedly a fit subject for restraint. (See Pagan, 75.) The more he approaches to this condition, the less difficulty we shall have in coming to a decision, and in a really doubtful instance there will be no impropriety in employing restraint; since, although the person is thereby deprived of liberty, it is better that this should happen, than that he or his friends should incur the risk of suffering severely by his insane conduct.

The forcible removal of a person to a lunatic asylum, unless the circumstances are of such a nature as to render immediate interference necessary on the ground of admitted or proved insanity, is unjustifiable in law, and may involve those concerned in the removal in a serious responsibility. The case of *Nottidge* v. *Ripley* (1849) is in this respect of some interest. A young lady of fortune was here clandestinely and violently removed from a place to which she had voluntarily retired,—examined by two medical witnesses nominated by those who had thus forcibly removed her, and then closely confined in a lunatic asylum for seventeen months without being allowed to communicate in any way with those members of her family who alleged that she was not insane, and who through these tortuous proceedings were unable to discover the retreat of their relative, and to have the case publicly investigated. At the trial for this abduction, the jury returned a verdict against those who were charged with the offence (Med. Gaz. xliv. p. 974.) The allegation of insanity was denied, although it was proved that the plaintiff had fallen into the hands of persons whose object was obviously to possess themselves of her property, and that, like her sisters, she had adopted some absurd and pseudo-religious notions. If, however, such violent measures were sanctioned before any preliminary inquiry, medical or otherwise, were instituted into the state of a person's mind, and upon the mere opinion of non-medical persons or interested relatives, no individual, whether sane or insane, could be assured of his liberty. This case has called forth some criticisms which the reader will do well to peruse. (See Journ. Psychol. Med. 1849, p. 564; and 1850, p. 14.)

In the case of *Hill* v. *Philp* (Exchequer, Feb. 1852) an action was brought by plaintiff to recover damages for alleged neglect and unskilful treatment while under the defendant's care as a lunatic patient. The plaintiff was examined, and he wished to impress the Court that he was then perfectly sane. His cross-examination, however, elicited the belief that "he was descended from Leofric, the wise Earl of Mercia, who was contemporary with Edward the Confessor." It was also proved that he had called for water from Jerusalem and the Jordan! In short, there was abundant evidence of insanity, and the jury returned a verdict for the defendant. The case, however, conveys an important caution that

medical men should be careful in the imposition of restraint, as from the evidence it appeared that unnecessary violence had been used on this occasion. There is another circumstance which renders this case of interest to medical practitioners, namely, whether in the treatment of a lunatic a medical man can justify the imposition of restraint by the allegation that he acted under the directions of or upon the request of the wife or other relative, at whose instigation the lunatic may have been confined. In *Hill* v. *Philp*, the judges decided that a medical man is, under such circumstances, bound to be guided by the directions of a wife, but that the directions must only be considered as guiding his judgment, and not as absolutely dictating to him; that he is still bound to exercise his own discretion, so far as to refrain from doing any thing, or adopting any course which might be injurious to the patient. A medical man is, therefore, ultimately responsible for his treatment of a lunatic. No person can give him authority to do that which is not in accordance with general practice or the necessity of the case. (For a report of this case, and some judicious remarks upon the decision, see the Legal Examiner, May 29, 1852, pp. 307, 318.)

In order to provide for the protection of lunatics and the prevention of undue violence, or frequency in the application of restraint, the law compels the keepers of asylums to enter in a book a report of each case or of each occasion in which any mechanical restraint is resorted to. An omission to make this entry is a misdemeanor; and at the Maidstone Lent Assizes, 1851, two medical gentlemen were convicted and fined for placing patients under restraint without having made the entries required by law (*Reg.* v. *Maddock.*) See also Med. Gaz. vol. xlvii. p. 556; and a paper on the use and abuse of Restraint, Journ. Psychol. Med. 1849, p. 240.

Violence of temper must not be taken as a proof of insanity. A man may have always had a violent temper, subject to occasional fits of aggravation, but this must not be confounded with mental disease. In order to determine whether the acts of a person be due to violent temper or insanity, it will be proper to ascertain what may have been his natural habits. The great feature of insanity is *change of character:* a man who is really insane is different to what he has previously been; but it may be proved, of a violent-tempered man, that he has always been the same. The greatest abuses of the restraint system have been chiefly observed in respect to monomania, where individuals have been forcibly imprisoned because they entertained some absurd delusions, over which, however, they had so great a power of control, as to render it somewhat difficult even for a shrewd and experienced examiner to detect them. When, at last, after many hours' cross examination, the existence of delusion has been made apparent, the result has been looked upon as furnishing matter for triumph and exultation; but, as Dr. Conolly justly remarks, one point in these cases appears to have been wholly lost sight of, namely,—What possible injury could have resulted to the patient or his friends from the existence of a delusion over which he had such complete control and mastery, as to render it a most laborious task to obtain any evidence of its presence? (Indic. of Ins.) It may be freely admitted, that where delusion does exist, there is reason to suppose that the mind must be more or less disordered in all its faculties; but such patients require close watching, not a rigorous imprisonment in an asylum. The greatest danger is to be apprehended in all those cases where there is the least power of self-control.

Certificates of insanity.—It will here be necessary to state the circumstances which require the attention of a practitioner when he is called upon to sign a certificate of insanity, whereby a person may be placed in confinement in an asylum. The act which specially refers to this subject is the 8th and 9th Victoria, c. 100, ss. 45, 46, 47, 48, and 49. This act, which came into operation on the 4th August, 1845, is a consolidation of all the statutes on the regulation of the care and treatment of lunatics. Its provisions are very stringent, both with respect to medical men who sign certificates, and those who keep asylums for the reception of lunatics.

According to section 45, no person (not a pauper) can be received into or detained in any licensed house or hospital, without an order from some person, and two medical certificates, which must be signed by *two physicians, surgeons or apothecaries* not in partnership, and each of whom shall *separately from the other* have personally examined the person to whom it relates not *more than seven clear days previously* to the reception of such person into such house or hospital, and shall *have signed and dated the same on the day* on which such person shall have been so examined.

Form of medical certificate in the case of private patients, s. 45.

I ———, being a physician *or* surgeon *or* apothecary duly authorized to act as such, hereby certify that I have this day examined A. B., the person named in the accompanying statement or order, and that the said A. B. is a lunatic [*or* an insane person, *or* an idiot, *or* a person of unsound mind,] and a proper person to be confined, and that I have formed this opinion from the following fact or facts; viz.

(Signed) Name.
Place of abode.

Dated this day of one thousand eight hundred and

Under the same section, any physician, surgeon, or apothecary, who shall *knowingly* sign any such medical certificate as aforesaid, which shall *untruly* state any of the particulars required by this act, shall be guilty of a misdemeanor. Hence it follows that a medical assistant not duly licensed, cannot sign a certificate for his employer, although there is reason to believe that the Act is thus occasionally evaded. (Med. Gaz. xliii. 763.)

The 46th section orders, for the first time, that every medical practitioner signing such certificate must specify *facts upon which his opinion is formed*, and whether these are derived *from his own observation* or from the information of any other person. The 47th section provides that in cases of emergency a person (not a pauper) may, under special circumstances (these being stated in the order,) be received into a house or hospital upon a certificate signed by *one* medical practitioner only, provided that within *three days*, another such certificate shall be signed by some other medical practitioner, not being connected with such house or hospital, upon a like examination. The detaining of a person upon one medical certificate only, beyond the period of three days, without such further certificate, is a misdemeanor in the keeper of the house or hospital.

By s. 48th the certificate of *one* medical practitioner only, signed according to the above rules, will suffice for a *pauper lunatic*, provided the party has been previously examined by a justice, clergyman, or overseer, and has received an order setting forth the particulars of the case.

By s. 49th no medical practitioner, who is interested in or attends a licensed house or hospital, or whose father, brother, son, or partner, is wholly or partly the proprietor of or a regular professional attendant in such house or hospital, shall sign any certificate for the reception of a patient into it, "and any physician, surgeon, or apothecary, who shall sign any certificate contrary to any of the provisions herein contained, or without having complied with all the provisions hereby required in the case of the patient to whom the same shall relate, or who shall in such certificate *describe his medical qualifications untruly*, or shall untruly state any thing therein, shall be guilty of a misdemeanor."

[Certain recent actions at law in this country in which heavy damages have been incurred by parties charged with arresting and detaining an alleged lunatic against the will and interests of the latter, have led to greater circumspection, not only among the friends of lunatics in the procurement of proper medical certificates and other forms required for the admission of insane patients into hospitals, but among the medical advisers in the preliminary examinations of the patients, and the filling up of their certificates. The principal hospitals for the insane of

swered by the friends and relatives, and the attending physicia

Some hospitals require the signature of two physicians to th cate, neither of them, of course, being connected with the hosp The State Lunatic Hospital of New Jersey requires the medica formally deposed to by two physicians before a magistrate.

Patients sometimes obtain their discharge on a writ of h proving their apparent fitness to be at large, but are generally re or discharged, when sufficiently recovered, at the discretion of th We are not aware of any legal restriction in this country on th sane patients except in cases of homicidal or otherwise danger have been confined by order of a magistrate or of a court of la can only be released by an authority similar to that which first There are patients of this class now in durance at the Eastern of Pennsylvania, and in the different State Asylums.—H.]

As ignorance of the law is never allowed to be an excuse f a medical man, unless acquainted with all the particulars abov easily subject himself to a prosecution; and he is not likely to grace and mortification attendant upon this, should it so happ of a doubtful nature. The law expressly requires from eac separate visit, a separate personal examination of the alleged l rate medical certificate, setting forth the *special fact or facts*, by himself or derived from the information of others, upon wh based.

Specification of facts.—Medical practitioners have had soi signing the fact or facts upon which their judgment of the i was based. (Med. Gaz. xxxvi. 1434; and xxxvii. 485.) W the description of a fact to render the certificate valid? Th tion was raised and decided in the case of *Shuttleworth* (Qu 17, 1847.) An application was made for the discharge of ground that the medical certificates did not set forth the *fa* opinion of those who signed them was derived. In one, it w lunatic laboured under a *variety of delusions*, and that she was *in the extreme*. In the other the certifier stated that he had

lief of the insanity of a party, will be a sufficient compliance with the 46th section of the statute to render the certificate valid. In other respects the terms of the certificate are sufficiently explanatory; and any violation of these will necessarily subject a practitioner to a trial for a misdemeanor. In June, 1848, a surgeon was tried and convicted at the Central Criminal Court of having certified that he had examined a female lunatic on the *day* on which he put his name to the document, when he had not seen her for two or three months. There was no doubt of the insanity of the party, but as this was an untrue statement, he was convicted of the offence.

Discharge of lunatics.—In forming an opinion relative to the propriety of discharging a person who has once been confined as a lunatic in an asylum, it is proper to examine the particulars of his case with the same caution as if the object were to confine him for the first time. The question of liberation is commonly restricted, like that of restraint, to cases of mania and monomania. It may so happen, that an individual has a lucid interval at the time of examination, in which case it will be necessary to make more than one visit. One who has been guilty of a heinous crime like murder, should never, on any pretence, be discharged. There are often long lucid intervals in homicidal mania; and it is impossible to be certain that the disease is entirely removed. If the individual has manifested the least disposition to suicide, we should be extremely cautious of liberating him; for suicidal mania is often artfully concealed under a cheerful exterior. We cannot always test the propriety of granting liberation by the lightness of the offence for which a criminal lunatic has been confined. The circumstances under which the most trifling offence has been committed may show that the mind is wholly unsettled with regard to moral responsibility; and such lunatics can never be trusted, even when there is great improvement in their language and deportment. The unhappy result of prematurely discharging a criminal lunatic, was seen in the case of a man named *Thom*, otherwise styling himself Sir William Courtenay. He was shot while rioting with many others near Canterbury in June, 1838. The whole life of this man seems to have been made up of a mixture of eccentricity and insanity. He was guilty of the most flagrant perjury, was tried, found insane, and confined as a lunatic. After a lapse of about six months, it was thought that he was so much improved as to allow of his discharge; although even at this time, it appears he fancied himself to be the Saviour! On his discharge, he was guilty of many extravagant acts; he collected a number of ignorant persons as his followers, and infected them with his delusion. He resisted the military who were sent to apprehend him, and eleven lives were lost on the occasion. A medical man cannot always be responsible for unfortunate consequences of this kind; but this and other similar instances show that great risk is incurred in hastily allowing the discharge of a lunatic, who has once been guilty of a crime, however slight, so palpably depending on a disordered mind. The 8th and 9th of Victoria, c. 100, has placed certain restrictions on the power of liberating lunatics. Under s. 72, the person originally signing the order which is required in addition to the medical certificates, may write an order for his discharge or removal: but under s. 75, this order is of no effect, if a medical practitioner certify that in his opinion such patient is dangerous and unfit to be at large, together with the grounds on which such opinion is founded, unless the commissioners or visiters shall, after the production of such certificate, give their consent in writing for the removal or discharge of such patient. Under other clauses, additional powers of discharge are given to the commissioners and visiters, subject to such restrictions as to leave the control for the most part in the hands of professional men. These powers of discharge do not, however, apply either to criminal lunatics, or to those found insane under a commission issued by the Lord Chancellor.

CHAPTER LXVI.

TESTIMONIAL CAPACITY OF LUNATICS—INTERDICTION—COMMISSIONS OF LUNACY—EXAMINATION OF ALLEGED LUNATICS—MEDICAL AND LEGAL TESTS OF COMPETENCY—LUCID INTERVALS.

Testimonial capacity of lunatics.—Since the former edition of this work was published, a question of some importance has arisen regarding the admissibility of the testimony of lunatics concerning facts which they allege they have witnessed. In the case of *Reg.* v. *Hill*, tried at the Central Criminal Court in the spring of 1851, the evidence of a man named Donnelly was tendered on the part of the Crown. (Jour. of Psychol. Med., 1851, pp. 279 and 436.) This man was a pauper lunatic, and was confined as such in the same ward with the deceased, who, it was alleged, had been maltreated and killed by the prisoner. It was quite clear from the cross-examination of Donnelly at the trial, that he laboured under insane delusions,—that he was constantly visited by spirits, &c.: but, nevertheless, he gave a clear and consistent account of the mode in which deceased was treated by the prisoner, and although he firmly believed in the existence of spirits and their power of communicating with him, he appeared to have a full knowledge of the difference between truth and falsehood. His evidence was received, and upon this the prisoner was convicted. The case was subsequently argued in the Exchequer Chamber before all the judges, and decided in favour of the admissibility of the evidence. It may now, therefore, be considered as settled that a lunatic who labours under delusions, but who in the judgment of a medical practitioner is capable of giving an account of any transaction that happened before his eyes, and who appears to understand the obligation of an oath, may be called as a witness. (*Reg.* v. *Hill*, 2 Denison's Crown Cases, 254.) The rule laid down by Baron Parke is in accordance with this view; it is for the judge to say whether the witness is admissible, and then his credibility is a question for the jury. As old legal dicta on the subject we find the following:—"An idiot shall not be allowed to give evidence, (Co. Litt. b. 6; Gilb. Evidence, 144,) nor a lunatic (Ib.) except during the lucid interval;" (Archbold, Pleading and Evidence in Criminal Cases, 124,) but it is now known and admitted that the shades of insanity are infinite,—that some lunatics are as fully competent to observe and remember facts, and to understand the obligations of an oath, as persons who are sane; hence, therefore, incompetency to give testimony must not be inferred from a mere name assigned to a malady, but it must be decided by the special condition of the lunatic. Under any other view, crimes of the greatest enormity might be perpetrated in lunatic asylums without the possibility of convicting the criminals. It has been appropriately remarked by a good authority, that the fact of incompetence to testify is not necessarily connected with the state of insanity; and it would be far more correct to consider it an independent fact to be established by a distinct order of proofs. The truth is, an analogy in a medico-legal sense has been too hastily assumed between the act of testifying and that of performing business contracts, and other civil acts; and, in consequence, has shared with them in the same sentence of disqualification without an attempt to ascertain the kind and degree of intellectual power which they respectively require. (Ray, Medical Jurisprudence of Insanity; see Medical Gazette, vol. xlvii. p. 150.) In the spring of 1852, I saw Donnelly, the witness in the above case, in the Colney Hatch Lunatic Asylum. His powers of observation and reasoning were very acute and quite sound, except when reference was made to his peculiar delusions regarding spirits.

Interdiction. Commissions of Lunacy.—By interdiction we are to understand the depriving of a person labouring under mental disorder, of his civil rights; in

other words, preventing him from exercising any control or management over his affairs. It may be with or without restraint, for one condition does not necessarily imply the other. When an individual, from mental incompetency, is liable to be imposed upon by others, or is guilty of foolish and extravagant acts, whereby his property is damaged, a Commission is commonly granted by the Court of Chancery, in order to determine whether he be "*compos*" or "*non compos mentis.*" This writ is well known under the name of "*de lunatico inquirendo.*" Before it can be issued, it is necessary, among other matters, that there should be affidavits, made by two or three physicians or surgeons, certifying to the insanity of the party. It has been already explained that the object of the law is to determine whether the incapacity to manage affairs be owing to some *mental* defect or disorder, and not merely to want of education or bodily infirmity,—otherwise all wealthy minors and infirm persons might be improperly deprived of the control of their affairs. It is unfortunate that these commissions are conducted on so expensive a scale as to render them applicable only to the wealthy classes of society; and even here the expenses attending such a simple inquiry as that for which the commission is issued, are often of the most ruinous kind, and the results are by no means satisfactory. (See the cases of *Mr. Davies*, *Miss Bagster*, and others.) When insanity is pleaded in a criminal case, one judge and twelve jurors will decide the question, affecting as it does the *life* of a party, in a few hours, and at very little expense! It is difficult to understand why, in a question of competency to manage affairs, so many more functionaries should be required, so much more time, sometimes amounting to twelve or fifteen days, occupied, so many witnesses examined, and such enormous expenses should be thereby incurred. (See cases of *Miss Bagster*, July, 1832, and of *Lady Kirkwall*, Feb. 1836.) The property of tradesmen, and of other persons of small means, is under such a system left unprotected. This expensive process of wasting an alleged lunatic's fortune in order to determine whether he be or be not likely to waste it himself, leads to the result that, compared with the number of lunatics under confinement, the inquisitions are very few. Out of 3774 persons confined in 1850 above the pauper class, there were only 338 cases in which inquisitions were held, *i. e.* there is only one lunatic in eleven whose property is thus protected by a commission, apparently because the protection involves such an enormous expenditure. (Med. Gaz. vol. xlvi. p. 1023.

One source of difficulty on these occasions is, that medical witnesses are allowed to be summoned by both parties, and the opinions given often exactly neutralize each other: they are hereby converted into partisans in the cause, as much as if they were counsel. It has been well remarked, that a man, even unknown to himself, with the purest intentions and the most perfect rectitude, will insensibly lean to the side on which he has been employed. (Pagan, 301.) The public are apt to infer, from such conflicting opinions emanating from men of equal experience, that the difference cannot depend essentially on the medical facts of the case; and that the question might be better determined by non-professional persons. See the case of *Carpenter*, Dublin Med. Press, July 16, 1845, p. 46; also that of *Mrs. Cumming*, in which the conflict of medical testimony was even greater than usual. As there is to be a new inquiry in this case, if the means of the alleged lunatic will allow of the expenditure, it would not be proper at the present time to give an analysis of the evidence adduced at the inquisition; but the reader will find a very elaborate report of the case in the Journal of Psychological Medicine for April, 1852. The inquiry occupied seventeen days! A remedy for this serious evil would be, that medical witnesses on such occasions should be appointed, like the commissioners, by the Chancellor, and they would be thereby made perfectly independent of both parties. At present they rather occupy the position of medical counsel than medical witnesses; for it is quite clear that no one would be summoned whose views did not coincide exactly with those of the party summoning him; and it is an opinion among some solicitors,

for which, unfortunately, there is an apparent reason, that medical evidence on these occasions is a marketable commodity, and may be purchased at graduated prices! The reader will find some remarks on this subject in the Medical Gazette, vol. v. 719; xi. 740; and xvii. 816.

Examination of alleged lunatics.—To determine whether a person is or is not a fit subject for interdiction, it is necessary to bear in mind that it is not enough to show there is delusion, as in the lighter cases of monomania, but we are bound to determine how far the delusion affects the judgment of a party, so as to prevent him, like other men, from managing his affairs with provident care and propriety. In many instances, however, proof of *delusion* only is sought for; and if this be procured, it is somewhat hastily inferred that the party is entirely incompetent to the management of his property. The most difficult cases are those involving questions of imbecility. In conducting the examination of an alleged lunatic, we should compare his mind as it is with what it has been; and if it be a case of supposed imbecility, a proper regard must be had to age, society, education, and general conduct. We should also consider whether the person has been treated by his friends and relations as a lunatic or imbecile prior to the issuing of the commission. A young person, whose education has been much neglected, and who has never been intrusted with the care of money, cannot be expected to have much knowledge of the method of managing a large property. Questions are sometimes put on the moral responsibility of man and the attributes of God to one who, perhaps, never heard of metaphysics. Arithmetical questions are asked which would embarrass many persons who are set down as sane and competent. In a case which occurred a few years since, one examiner asked the alleged imbecile, who said he had £1,200 in the bank, and received £20 for interest,—How much was that per cent.? He said "he could not tell; he was no good hand at arithmetic." The counsel who appeared against the brieve or commission afterwards put the same arithmetical question to one of the medical witnesses who had deposed to the imbecility of the party; and this witness, an educated man, confessed himself unable to answer it—a practical illustration of the impropriety of pronouncing a person to be imbecile merely because he is ignorant of what he has never been taught! (Case of *David Yoolow*, 1837.) If the capacity to manage affairs rested solely upon a knowledge of arithmetic, many now go free who ought to be immediately placed under interdiction. This is rather a commercial test of insanity; but it will be found that it has been applied in a very improper way to determine the capacity of young and ill-educated females. Unless the questions be confined to those subjects which the party has had either the opportunity or inclination to learn, a medical witness will always incur the risk of confounding mere ignorance with imbecility. Perhaps one of the best tests of mental capacity will be found in determining the degree to which, with ordinary opportunities, the individual has shown himself capable of being instructed. Too high a standard must not be assumed as a test for capacity. The mind of an alleged imbecile should not be compared with the most perfect mind, but with that of another person of average capacity, of the same age and station in society, and who has enjoyed like opportunities of instruction. (See Ann. d'Hyg. 1836, i. 192.)

A medical witness must not allow himself to be embarrassed by medical or legal definitions of insanity. The malady may not have the form of lunacy or idiocy in a strictly legal view; nor of mania, monomania, dementia, or idiocy, in a strictly medical view; but still it may be a case of *such mental disorder* as to create *an incapacity for managing affairs*. This is the point to which a medical examiner has to direct his attention. Dr. Conolly has suggested one method of testing the state of mind, which it would be advisable to adopt, namely, to cause the individual to express his thoughts in writing. He would not here be led to suspect that he was being subjected to an examination for a hostile purpose. In many cases, the evidence of a strong delusion existing in the mind has been

derived from a will, deed, or letters written spontaneously by the lunatic or imbecile, when there was considerable difficulty in obtaining this proof by a verbal examination.

Among many cases which might be here cited to illustrate the medical evidence required and received on commissions of lunacy, one may be selected which excited much interest at the time of its occurrence; I allude to that of *Miss Bagster*, which underwent inquiry in July, 1832. It will serve to show upon what slight grounds a verdict of "unsound mind" may be returned under commissions of lunacy, as they are at present conducted. The subject of this inquiry was shown by the evidence to be a frivolous and weak-minded girl, whose education had been much neglected. She was heiress to a large fortune, and contracted a clandestine marriage unsuited to her condition. A commission was taken out by her friends for the purpose of annulling her marriage, by showing that she was not at the time competent to give rational consent. The general evidence established that there had been great neglect in her education, and that she had been especially indulged; but it did not appear that she had ever been treated by her friends as of unsound mind, nor, indeed, that any question of her insanity had been raised, until *after* the marriage. Seven medical witnesses summoned to support the commission, deposed that she was of unsound mind. On the other side no witnesses were called, as it was considered that the allegation of insanity was not made out. The Commissioners, however, themselves, called Dr. Morrison and Dr. Haslam, who deposed that her incompetency to manage her affairs arose, not from unsoundness of mind, but from ignorance. She gave one strong proof of her sanity, namely, that she was aware of her deficiencies. It seems to have been allowed that she was capable of controlling herself, and concealing her defects; her answers to the questions put to her were pertinent, and were for the most part correctly made, and she had capacity to receive instruction. She was ignorant of arithmetic, but this she had never been properly taught. She was young and inexperienced, and therefore unable to answer questions relative to the management of a household. The jury, by a majority of twenty to two, returned a verdict that she was of unsound mind, and had been so for the space of two years—a time which covered the marriage. (See, for an excellent medico-legal report of this case, Med. Gaz. x. 519, et seq.)

It is worthy of remark, that the only two medical witnesses, independent of both sides, who were summoned by the Commissioners, gave a very strong opinion that Miss Bagster was *ignorant*, and not of unsound mind; and that she might, by instruction, be rendered competent to the management of her affairs. We should imagine that where the question arose, whether a young person was or was not to be deprived of all civil rights, there ought to be at least unanimity among the medical opinions, or, if this were denied, then more weight should be given to the negative than to the affirmative side of the question, providing if, as in this case, the negative view were supported by men impartially selected, and of great experience and knowledge on the subject of insanity. It is not improbable that besides ignorance, there may have been some degree of weakness of mind about this person; yet, taking the whole case, we must attribute the verdict of unsoundness, not so much to mental infirmity as to incapacity, for want of instruction, to manage a large fortune. But if every wealthy young lady, whose education had been much neglected, had her sanity tested on the same points as Miss Bagster, it is certain that many who are now free agents would be placed under interdiction! It has been attempted to justify the verdict by the statement, that it saved her from the results of an imprudent marriage—the answer to which is, that commissions of *lunacy* are not intended to shield persons whose minds are not really unsound, from the results of foolish and imprudent acts!

Commissions may be superseded, but the evidence in such a case must be as strongly in favour of sanity as it was before in favour of insanity. In *Dyce*

Sombre's case, July, 1844, the physicians of England and France came to directly opposite conclusions! See the judgment of the Lord Chancellor, as reported in the Law Times, Sept. 28, 1844; also a notice of a treatise on his own case and the law of lunacy by Mr. Dyce Sombre, Journ. Psychol. Med. 1850, p. 409. There have been few cases in which so great a difference of opinion has existed among medical witnesses as in this. Five English medical practitioners of good standing were, however, in favour of the sanity of the party. The decision was against superseding the Commission, chiefly on the ground of the existence of delusion: but the most extraordinary part of the case was, that the alleged lunatic was allowed to have the uncontrolled use of a large portion of his property! (Med. Gaz. xl. 899.) In 1851, arrangements were made for an independent medical Commission to inquire into the mental state of this gentleman, and, if possible, to reconcile the conflicting medical opinions already given; but before this was constituted, the alleged lunatic died. For some remarks on this case, see a letter by Dr. Mayo, Med. Gaz. xlvi. p. 123.

Lucid intervals.—By a lucid interval, we are to understand a temporary cessation of the insanity, or a perfect restoration to reason. Thus, then, it differs entirely from a remission, in which there is a mere abatement of the symptoms. It has been said that a lucid interval is only a more perfect remission; and that although the lunatic may act rationally and talk coherently, yet his brain is in an excitable state; and he labours under a greater disposition to a fresh attack of insanity than one whose mind has never been affected. Of this there can be no doubt, but the same reasoning would tend to show that insanity is never cured; for the predisposition to an attack is undoubtedly greater in a recovered lunatic than in one who is and has always been perfectly sane. Even admitting the correctness of this reasoning, it cannot be denied that lunatics do occasionally recover for a longer or shorter period to such a degree as to render them perfectly conscious of, and legally responsible for their acts like other persons. The law intends no more than this by a lucid interval: it does not require proof that the cure is so complete that even the predisposition to the disease should be entirely extirpated. Such proof, if it could even be procured, would be totally irrelevant. If a man acts rationally and talks coherently, we can have no better proof of a restoration to reason. If no delusion affecting his conduct remain in his mind, we need not concern ourselves about the degree of latent predisposition to a fresh attack, which may still exist.

Lucid intervals sometimes appear suddenly in the insane. The person feels as if awakened from a dream, and there is often a perfect consciousness of the absurdity of the delusion under which he was previously labouring. The duration of the interval is uncertain; it may last for a few minutes only, or may be protracted for days, weeks, months, and even years. In a medico-legal view, its alleged existence must always be looked upon with suspicion and doubt when the interval is very short. The lucid intervals are most frequently seen in cases of mania and monomania; they occasionally exist in dementia when this state is not chronic, but has succeeded a fit of intermittent or periodical mania. They are never met with in cases of idiocy and imbecility. It is sometimes a matter of great importance to be able to show whether or not there exists, or has existed, a lucid interval; since, under these circumstances, the acts of an individual are deemed valid in law. The mind should be tested, as in determining whether the patient be labouring under insanity or not. He should be able to describe his feelings, and talk of the subject of his delusion, without betraying any signs of unnecessary vehemence or excitement. It may happen that a person who is the subject of a Commission of inquiry is, at the time of examination, under a lucid interval, in which case there may be some difficulty in forming an opinion of the existence of insanity. This occurred in the case of *Lady Seymour* (July, 1838:) when examined before the Commission, her replies were so rational and collected that no verdict could be given, and the case was adjourned. When

the inquiry was resumed, it was satisfactorily proved that she was insane, not merely by general and medical evidence, but by the terms of her will which had been drawn up by herself. The same circumstance happened in the cases of *Mrs. Hartley* and *Mr. Pearce*, who were the subjects of Commissions in 1843. It has been said that a person in a lucid interval is held by law to be responsible for his acts, whether these be of a civil or criminal nature. In regard to criminal offences committed during a lucid interval, it is the opinion of some medical jurists that no person should be convicted under such circumstances; because there is a probability that he might at the time have been under the influence of that degree of cerebral irritation which renders a man insane. (Prichard.) This remark applies more especially to those instances where the lucid interval is very short. Juries now very seldom convict, however rationally in appearance a crime may have been perpetrated, when it is clearly proved that the accused was really insane within a short period of the time of its perpetration.

CHAPTER LXVII.

RESPONSIBILITY IN CIVIL CASES—INSANITY AS AN IMPEDIMENT TO MARRIAGE—DEEDS AND CONTRACTS—WILLS MADE BY THE INSANE—TESTAMENTARY CAPACITY—TEST OF CAPACITY—DELUSION IN THE DEED—ECCENTRICITY IN WILLS—WILLS IN SENILE DEMENTIA—WILLS IN EXTREMIS—RESTRICTION OF MEDICAL OPINIONS.

RESPONSIBILITY IN CIVIL CASES.

Insanity as an impediment to marriage.—Insanity is deemed in law to be a civil impediment to marriage, because it is considered that there cannot be that rational consent which is necessary to the validity of the contract. The marriage of a lunatic is therefore called a nullity, and is void *ab initio*. All that the law requires is, that there should be good proof of insanity at or about the time of the contract. If this be offered, and it be alleged that the contract was entered into during a lucid interval, then the party who would benefit by the allegation must prove it. The suitableness of the marriage, as well as the conduct of the party during or after its performance, will also be considered by the Court. In the case of *Turner* v. *Myers*, a lunatic who had recovered from his lunacy instituted a suit to set aside a marriage which he had contracted while in that state. The marriage was declared void. (Med. Gaz. viii. 481.) The case of *Baldry* v. *Ellis*, (Norwich Summ. Ass. 1851,) will be found of interest in relation to the matrimonial engagements of alleged lunatics.

In the case of *Read* v. *Legard*, (Court of Exchequer, May 30, 1851,) a question arose whether a lunatic was responsible for necessaries supplied to the wife. The articles supplied were for the sole use of the wife, the husband being a confirmed lunatic, and the inmate of an asylum. The Court held that the fact of a husband being from the visitation of God unable to manage his affairs, did not absolve him from the obligation which he contracted when he married, to provide necessaries for the support of his wife. He was then of sane mind, and although he had subsequently become insane, that obligation was not revocable under the circumstances. (See also a report of the case of *Seaton* v. *Adcock*, Journ. Psychol. Med., 1851, p. 297.)

The validity of civil contracts entered into by lunatics will depend mainly on the circumstances which accompany the act. If there be nothing unreasonable in the conduct of the lunatic, and the party with whom he contracts has no knowledge or suspicion of the insanity, then the contract will be binding on the lunatic and his representatives. It was so held in one of the most recent cases

(*Moulton* v. *Cameroux*, Exchequer, June, 1848.) This was an action by the administrator of a deceased person, to recover from the defendant, as secretary of an insurance office, the sum paid by him as the consideration for two annuities, the foundation of the action being, that at the time of the arrangement in question, the deceased was not in a sound state of mind. At the trial before the Chief Baron it appeared that the negotiation had been conducted by the deceased with apparent prudence, sanity, and judgment, and that the arrangement entered into by him with the office was just such as any ordinarily prudent person would have been expected to make with a view to his own interest. The deceased, who died very soon after the business had been arranged, was, both before and after, in an unsound state of mind. Under these circumstances this action was brought by his representatives, and a verdict recovered by them, subject to the opinion of the Court on their right to recover as on the entire failure of consideration. The Chief Baron, in giving judgment in favour of the defendant, said it was sufficient for the purpose of this case to lay it down as a general rule, that when a person of apparently sound intellect enters into a contract such as any other ordinary person would enter into with others who act *bonâ fide*, and the parties cannot be restored to their former condition, it is no ground for setting aside the contract, that one of them was at the time *non compos mentis*. On appeal to the Exchequer Chamber this judgment was affirmed in May, 1849. (See also the case of *Staniland* v. *Willett*, Vice Chancellor's Court, Nov. 1848.)

Wills made by the insane. Testamentary capacity.—Questions involving the testamentary capacity of individuals are of very frequent occurrence, and medical evidence is commonly demanded. When property is bequeathed by a testator out of the usual order of succession, it may be alleged by the relatives that he was wholly incompetent to understand the nature of the deed—either from actual insanity, the imbecility of age, or that natural failing of the mind which is so often observed to occur on the approach of death. Bodily disease or incapacity does not affect the validity of a will, unless the mind be directly or indirectly disturbed by it. Some time since a case occurred in France, in which a will was contested on the ground that the testator, when he executed it, was labouring under hemiplegia. The opinion of Esquirol was demanded, and he said that hemiplegia might undoubtedly affect the brain, a fact clearly indicated by the sight, hearing, and other senses becoming weakened; yet this, in his opinion, did not necessarily indicate an impairment of the understanding. (Ann. d'Hyg. 1832, i. 203.) A man's mind, under these circumstances, may not be so strong as in robust health, but still it may retain a disposing power. In the case of *Harwood* v. *Baker*, decided by the Privy Council in 1841, a will was pronounced to be invalid, owing to the general state of bodily disease in which the testator was at the time of making it. It appears that he was labouring under erysipelas and fever, and these diseases had produced a degree of drowsiness and stupor which rendered him incompetent to the act. In the case of *Day*, (June, 1838,) epilepsy was alleged to have affected the mind; and in the case of *Blewitt*, (March, 1833,) paralysis was adduced as a ground of incompetency. In all cases of this kind, the law looks exclusively to the actual *effect* of the bodily disease upon the *mind;* and this is commonly a purely medical question. In the case of *Penfold* v. *Crawford*, (C. P. Dec. 1843,) it was shown that the testator had lost his speech from an attack of apoplexy; but it was proved, by medical evidence, that his mental powers were good, and therefore a deed made subsequently to the attack was held to be valid. *Integritas mentis non corporis sanitas exigenda est.* In the case of *Whyddon* v. *Billinghurst* (Prerog. Court, July, 1850,) a will was set aside because it was executed by the testatrix while labouring under an attack of cholera, in Sept., 1849, and proper means had not been taken to test the capacity of the deceased, who, at the time of its execution, was reduced to an extreme state of weakness.

Test of capacity.—A person is considered to be of a sane and disposing mind

who knows the nature of the act which he is performing, and is fully aware of its consequences. From some decisions that have been made, it would appear that a state of mind for which a party might be placed under interdiction would not render him incompetent to the making of a will. The validity of the will of a lunatic was once allowed, although made while he was actually confined in an asylum, because the act was rational, and it was such as the lunatic, some years prior to the attack of insanity, announced his intention of making. (*Coghlan's* case; see also, Re *Garden*, Law Times, July 6, 1844, p. 258.) The insanity of a party, when not already found insane under a commission, must not, in these cases, rest upon presumption, but be established by positive proof. The commission of suicide is often hastily assumed to be evidence of insanity; but it would not be allowed as a proof of this state, even when a testator destroyed himself shortly after the execution of the will. A case has been decided, where the testator committed suicide three days after having given instructions for his will; but the act was not allowed to be a proof of insanity, and the will was pronounced to be valid. A similar case has been thus decided in the French Courts. Besides, as we shall see hereafter, suicide is not deemed in law to be a proof of insanity.

Delusion in the deed.—The validity of deeds executed by persons affected with monomania often becomes a subject of dispute. The practice of the law here indicates that the mere existence of a delusion in the mind of a person does not necessarily vitiate a deed, unless the delusion form the groundwork of it, or unless the most decisive evidence be given, that at the time of executing the deed, the testator's mind was influenced by it. Strong evidence is often derivable from the act itself, more especially where a testator has drawn it up of his own accord. In the case of *Barton*, (July, 1840,) the Ecclesiastical Court was chiefly guided in its decision by the nature of the instrument. The testator, it appeared, laboured under the extraordinary delusion that he could dispose of his own property to himself, and make himself his own legatee and executor! This he had accordingly done. The instrument was pronounced to be invalid. But a will may be manifestly unjust to the surviving relatives of a testator, and it may display some of the extraordinary opinions of the individual, yet it will not necessarily be void, unless the testamentary dispositions clearly indicate that they have been formed under *a delusion*. Some injustice may possibly be done by the rigorous adoption of this principle, since delusion may certainly enter into a man's act, whether civil or criminal, without our being always able to discover it; but after all, it is perhaps the most equitable way of construing the last wishes of the dead.

Eccentricity in wills.—The evidence in these cases sometimes amounts to proof of eccentricity only on the part of the testator, or in the deed itself; but a clear distinction must be here drawn. The will of an eccentric man is such as might always have been expected from him—the will of one labouring under insanity (delusion) is different from that which he would have made in an unaffected state; —the instrument is wholly different from what it would once have been (see page 553, ante.) It has been justly observed, that the insane are eccentric in their ideas, their language, or their conduct; but the merely eccentric have but a voluntary resemblance to the insane. (Jamieson's Lectures, Med. Gaz. xlvi. p. 180.) In the case of a *Mr. Stott*, a medical electrician, whose will was disputed by his daughter on the ground of insanity, it was proved that the testator fancied he could deliver pregnant women by means of electricity, and he actually proposed to the wife of a baker living in the neighbourhood, to bring about her accouchement by an electrical machine! The will was pronounced invalid, not so much on account of this extreme absurdity, as of the violent and unnatural treatment to which he had subjected his daughter. It appeared that he had taken, as we now and then find in monomaniacs, a most unaccountable and causeless dislike to this girl from her earliest infancy. Strange as it may appear, elec-

tricity has been lately used as a means of aiding parturition, but under circumstances very different from those which gave rise to the absurd delusion in the case just related. (Med. Gaz. xxxvi. p. 376.) It has become a grave question, whether proof of *moral insanity, i. e.* a perverted state of the moral feelings or affections, independently of any direct evidence of intellectual disturbance, should be a sufficient ground to set aside the act of a testator. In the case of *Frere* v. *Peacocke* (Prerogative Court, Oct. 1845,) this was the principal question at issue. The counsel who maintained the validity of the will argued against the admissibility of Pinel's doctrine of moral insanity, chiefly because there was a difference of opinion among those who adopted the doctrine, whether it was or was not invariably accompanied by some mental derangement. A doctrine thus novel, unsettled, and not sufficiently developed, could not, it was urged, be safely applied to legal questions. If a man who was free from delusions (as the deceased in this case was,) and capable of acts of business (as he was,) might nevertheless be held to have been insane, it would involve this branch of testamentary law in utter confusion. A man who was not a subject for a commission of lunacy, might be held after death to have been morally insane. The court would have to deal with cases of kleptomania and pyromania, in which the individuals exhibited no trace of intellectual insanity or delusion of mind. It was safer to rely upon the ancient and general doctrine of these Courts, *that there was no insanity without delusion,—its true criterion;* and that in the present case the deceased, though eccentric, was not of unsound mind. The Court found that the will was valid, and that there was no proof of delusion. The deceased was a most unamiable being, but still his acts were not irrational, nor inconsistent with soundness of mind. (Prerog. Court, Aug. 1846.) In no case probably, has eccentricity come so near to insanity as in this. The reasoning of counsel in support of the sanity of the testator would, however, go to the extent of excluding a plea of insanity in many criminal cases in which our Courts have not hesitated to receive it; and therefore it would lead to the novel conclusion, that a man affected with moral insanity, who murdered his wife from perverted feeling, would be held irresponsible for the act in *criminal law;* but if, under the *same perverted feeling*, he bequeathed his property to an utter stranger, and left her penniless, the deed would be valid in *civil law!* There does not appear to be any reason why such a distinction should be made; even supposing the decision in the case of Mr. Stott not to be in some respects adverse to it.

Wills are sometimes contested more on the ground of eccentricity than of insane delusion; but if eccentricity only be proved, a Court will not interfere. In the case of *Morgan* v. *Boys* (1838,) it was proved that the testator, by his will, had left a large fortune to his housekeeper. This will was disputed on the ground that it bore intrinsic evidence of the deceased not having been in a sane state of mind at the time of making it. After having bequeathed his property to a stranger, the testator directed that his executors should "cause some parts of his bowels to be converted into fiddle-strings,—that others should be sublimed into smelling salts, and that the remainder of his body should be vitrefied into lenses for optical purposes!" He further added, in a letter attached to his will—"The world may think this to be done in a spirit of singularity or whim, but I have a mortal aversion to funeral pomp, and I wish my body to be converted to purposes useful to mankind." Sir H. Jenner, in giving judgment, held that insanity was not proved:—the facts merely amounted to *eccentricity*, and on this ground he pronounced for the validity of the will. It was proved that the deceased had conducted his affairs with great shrewdness and ability; that he not only did not labour under imbecility of mind, but that he had been always treated during life as a person of indisputable capacity by those with whom he had to deal. The best rule to guide the Court, the judge remarked, was the conduct of parties towards the deceased; and the acts of his relatives evinced no distrust of his sanity or capacity while he was living. The deceased had always been

noted for his eccentric habits, and he had actually consulted a physician upon the possibility of his body being devoted to chemical experiments after death. In the case of *Mudway* v. *Croft* (Prerog. Court, Aug. 1843,) a will contested on the ground of insanity, but defended on the plea of eccentricity, Sir H. J. Fust said,—"It is the prolonged departure, without an adequate external cause, from the state of feeling and modes of thinking usual to the individual when in health, that is the true feature of disorder in mind." See also the case of *Waring* v. *Waring* (Prerog. Court, Feb. 1847.) The case of *Yglesias* v. *Dyke* (Prerog. Court, May, 1852,) presents some singular points of interest in reference to the distinction between eccentricity and insanity. The testatrix had bequeathed by her will a considerable amount of property, which was claimed by the Crown, as she was illegitimate, and as it was alleged incompetent to make a will. It was proved that she was of dirty habits, and among other facts that she kept twelve or fourteen dogs of both sexes, which were provided with kennels in her drawing-room! Two of the dogs slept in the same room, and one, which was blind, slept in the same bed with her! The testatrix also had a propensity for guinea-pigs, and was subject to some singular delusions. Some evidence was adduced to show that, in spite of these strange freaks, she was able to manage her own affairs; but the Court pronounced against the validity of the will, on the ground that the testatrix had for a long period laboured under insane delusions, and there was no proof that these had ceased. Her eccentricity was the result of insanity. See also the case of *Dryden* v. *Fryer* (Q. B. Dec. 1850,) Journal Psychol. Med. 1851, p. 285.

Wills in senile dementia.—Wills made in incipient dementia arising from extreme age, (senile imbecility,) are sometimes disputed, either on the ground of mental deficiency, or from the testator, owing to weakness of mind, having been subjected to control and influence on the part of interested persons. If a medical man be present when the will is made, he may easily satisfy himself of the state of mind of the testator, by requiring him to repeat from memory the mode in which he has disposed of the bulk of his property. Medical men have sometimes placed themselves in a serious position by becoming witnesses to wills under these circumstances, without first assuring themselves of the actual mental condition of the testator. It would always be a good ground of justification, if, at the request of the witness, the testator had been made to repeat substantially the leading provisions of his will from memory. If a dying person cannot do this without prompting or suggestion, there is reason to believe that he has not a sane and disposing mind. It has been observed on some occasions, when the mind has been weakened by disease, or infirmity from age, that it has suddenly cleared up before death, and the individual has unexpectedly acquired a disposing capacity. (Ann. d'Hyg. 1831, 370.) In the case of *Durnell* v. *Corfield*, (Prerog. Court, July, 1844,) where an old man of weakened capacity had made a will in favour of his medical attendant, Dr. Lushington held that there must be the clearest proof, not only of the *factum* of the instrument, but of the testator's knowledge of its contents. (Law Times, July 27, 1844.)

Wills in extremis.—Wills made by persons whose capacity during life has never been doubted; while lying at the point of death, or, as it is termed, in extremis, are regarded with suspicion, and may be set aside, according to the medical circumstances proved. Many diseases, especially those which affect the brain or nervous system, directly or indirectly, are likely to produce a dulness or confusion of intellect, under which a disposing power is lost. Delirium sometimes precedes death, in which case a will executed by the dying person would be at once pronounced invalid. [See Ray, *Med. Jur. of Insanity*, 304, for some interesting cases.—H.]

Restriction of medical opinions.—In an important case, (*Bainbrigge* v. *Bainbrigge*, Oxford Summer Ass., 1850,) tried before Lord Campbell, in which the testamentary capacity of the testator was disputed, it was held that a medical

witness, although conversant with cases of insanity, cannot be asked his opinion as to the insanity of a testator founded upon the evidence given at the trial in his hearing. (4 Cox, Criminal Cases, 454.) See on this subject Med. Gaz., xlvi., p. 240.

CHAPTER LXVIII.

THE PLEA OF INSANITY—HOMICIDAL MONOMANIA—MORAL INSANITY—CAUSES—SYMPTOMS—LEGAL TESTS—MEDICAL TESTS—MOTIVE FOR CRIME—CONFESSION—ACCOMPLICES—DELUSION IN THE ACT—SUMMARY—TEST OF IRRESPONSIBILITY—CASES IN ILLUSTRATION—SUMMARY OF MEDICAL EVIDENCE.

RESPONSIBILITY IN CRIMINAL CASES.

The plea of insanity.—The rule of law with regard to this subject is, that no man is responsible like a sane person for any act committed by him while in a state of insanity. This is a subject of considerable importance in a medico-legal view; for should a plea of insanity be improperly admitted in any criminal case, then punishment is made to fall unequally on offenders; and if, on the other hand, it be improperly rejected, punishment is administered with undue severity. A plea of insanity may be raised for the smallest offence up to the highest crime—murder; but it is rarely raised in respect to smaller offences, because the close confinement to which the offender, if found insane, would necessarily be subjected, would often be a heavier punishment than that which the law actually prescribes for the offence which he may have committed. In a case of felonious assault lately tried, it was urged by the counsel in defence, that the prisoner was insane; but the evidence on this point was not by any means conclusive,—when it was intimated by the Court that if this plea were admitted the party would probably undergo a much longer imprisonment, than if on conviction he received the legal punishment for the offence. (See the case of the *Queen* v. *Reynolds*, Bodmin Aut. Ass., 1843.) The judge is reported to have said that there was no proof of insanity. If the prisoner was pronounced insane, he might be imprisoned for life, and therefore he did not think *that* finding would benefit him! A verdict of guilty was returned, and the man was sentenced to eighteen months' imprisonment. This case shows at least that a defence of this kind may be sometimes indiscreetly put forward. Murder, incendiarism, and theft, are the crimes for which this plea has been chiefly raised—and it has been more especially confined in this country to those cases where persons have been charged with murder or attempts at murder. The attempt to establish this plea in cases of murder by poison, has generally ended in failure, although there may have been proof of hereditary insanity. (*Reg.* v. *Gallop*, Somerset Winter Ass. 1844, and *Reg.* v. *Allnutt*, C. C. C., Dec. 1847.) The crime of poisoning indicates malice and deliberation in a greater degree than it would be in general safe to admit as co-existing with a state of insanity. Alison, however, mentions one case of acquittal (*Sparrow*, 1829,) in which this plea was admitted. The woman poured a large quantity of vitriolic acid down the throat of her own child. She then ran to a neighbour's house in a state of evident derangement, saying that she had killed the devil. Her insanity was clearly proved, and she was acquitted. (Crim. Law, 648.) It is customary to say that they who commit these heinous crimes while labouring under insanity, are irresponsible. By this we are not to understand that they are allowed to go free. On the contrary, they are subjected to close confinement, commonly perpetual, as it assuredly ought to be in all cases of murder; but depending on their recovery in respect to crimes of less magnitude. A power is vested in the executive only, to discharge recovered lunatics, according to circumstances.

HOMICIDAL MONOMANIA.

Homicidal monomania is commonly defined to be a state of partial insanity, accompanied by an impulse to the perpetration of murder; but most medical jurists admit that individuals who may not appear to labour under any *intellectual* aberration, are liable to be seized with a sudden destructive impulse, under which they will destroy those to whom they are most fondly attached, or any person who may happen at the time to be involved in the subject of their delusion. Sometimes the impulse is long felt, but concealed and restrained: there may be merely signs of depression and melancholy about the individual, and eccentric or wayward habits, but nothing to lead to a suspicion of the fearful contention which may be going on within his mind. Occasionally the murder may be perpetrated with great deliberation, and apparently under all the marks of sanity. These cases are rendered difficult by the fact that there may be no clear proof of the existence, past or present, of any disorder of the mind, so that it would appear the chief evidence of the existence of insanity is in the *act* itself: of the existence of insanity, in the common acceptation of the term, before and after the perpetration of the crime, there may be either no evidence whatever, or it may be so slight as not to amount to proof. These cases are regarded as instances of insanity of the moral feelings only, and this condition is called "*moral insanity.*" An unrestricted admission of this doctrine would, it is alleged, go far to do away with all punishment for crime, for it would then be impossible to draw a line between insanity and moral depravity, and the law will not excuse an act committed through moral depravity.

The works of Marc, Esquirol, and Prichard, abound in illustrations of this form of monomania; but I prefer selecting some of those which have occurred in England. The following case was tried on the Midland Circuit, July, 1837. (*Reg.* v. *Greensmith.*) The prisoner in this case was charged with the murder of four of his children. The facts here to be related were partly brought out in evidence, and partly by his own confession. He was a person of industrious habits, and an affectionate father; but having fallen into distressed circumstances, he destroyed his children by strangling them, in order, as he said, that they might not be turned into the streets. The idea only came to him on the night of his perpetrating the crime. After he had strangled two of his children in bed, he went down stairs, where he remained some time; but thinking he might as well suffer for all as for two, he returned to the bed-room, and destroyed the two whom he had left alive. He shook hands with them before he strangled them. He left the house and went to a neighbour's, but said nothing of the murder, until he was apprehended the next day and taken before the coroner, when he made a full confession. Not one of the witnesses had ever observed the slightest indication of insanity about him. He made no defence; but several medical practitioners came forward to depose that he was insane. The surgeon of the gaol said that the man was feverish, complained of headache, and had been subject to disturbed sleep and sudden starts since the death of his wife, a short time before. He spoke of the crime he had committed without the slightest excitement, and the witness said he had heard enough of the evidence to satisfy him that the prisoner could not have committed such a crime as this, and be in a sane state of mind. Dr. Blake, physician to the Nottingham Lunatic Asylum, said he was satisfied that the prisoner laboured under a delusion of mind. The prisoner's grandmother and sister had been under his care, the latter for entertaining a similar delusion, namely, a desire to destroy herself and her children. The prisoner was found guilty, and sentence of death was passed upon him. By the active interference of Dr. Blake and others, he was subsequently respited on the ground of insanity. (See Med. Chir. Rev. xxviii. 84.) For precisely analogous cases, followed by acquittals, see *Reg.* v. *Frost*, Norwich Summer Ass. 1844; and *Reg.* v. *Dickenson*, C. C. C., March, 1844. Other examples of homicidal

they were attached by the strongest ties.

It appears to me that such crimes as these cannot be fairly cribed to the acts of *sane* individuals; and even those who are on the existence of such a form of insanity as *homicidal* general compelled to admit that these dreadful motiveless m of insane and irresponsible agents. It may be a dangerous the *crime* as *evidence* of insanity, but these cases incontestabl are some instances in which this is the only procurable eviden v. *Brixey*, C. C. C., May, 1845, post.) My friend, Mr nies the existence of "moral insanity," quotes from the for work the cases of *Greensmith* and *Brixey*, in some remarks on the plea of insanity (Blackwood's Edinburgh Magazine, but he leaves it quite uncertain whether, in his judgment, have been executed for the murders, or whether the acquitta insanity were right and proper. The doctrine of moral ins to be fairly established by these two cases, for there was no evidence of *intellectual* aberration, or of insane conduct, if we petrated; and the acquittals produced no shock to the public cases of a really doubtful kind. Had not the homicides i above mentioned destroyed themselves, it is almost morall would have been acquitted on the ground of insanity. I *nought*, an acquittal actually took place: this man, who ha recovered, was tried, acquitted on the ground of insanity, a stroyed himself.

Causes.—The causes of homicidal monomania are assig cerebral irritation induced by bodily disease, extensive vicious education, erroneous notions of religion, grief, d power of imitation. With respect to the latter, it is a fact given to horrible occurrences often excites a homicidal fe *Hon. R. Touchett*, post.) The sight of a weapon, or o tim, also determines in an instant the perpetration of the feeling himself drawn on by an impulse which he can neithe Disordered menstruation, arising from sympathy of the ut

this may, however, be sometimes indicated by a sudden change of character.

Symptoms.—Homicidal monomania, in its more common form, may make its appearance *at all ages*, even in children not more than eight or ten years old:—it is usually periodical, and the paroxysm is preceded by symptoms of general excitement. The patient experiences colicky pains, and a sense of heat in the abdomen or chest,—headache, restlessness,—the face is flushed or very pale,—the pulse hard and full, and the whole body in a state of convulsive tremor. An act of violence is committed without warning, and the patient appears as if relieved from some oppressive feeling. He may be calm, and express neither regret, remorse, nor fear. He may coolly contemplate his victim, confess the deed, and at once surrender himself to justice. In some rare instances he may conceal himself, hide the weapon, and endeavour to do away with all traces of the crime. The symptoms just described have been observed to become more aggravated in proportion as the homicidal impulse was strong. The propensity to kill is sometimes a fixed idea, at others intermittent; and the patient can no more banish it from his thoughts than a person affected with insanity can divest himself of the delusive ideas which occupy his mind. (Esquirol, ii. 105.)

Legal tests.—Admitting, then, the existence of this state of homicidal monomania, it will become a question, how, when pleaded for one charged with murder, it is to be distinguished from a case where the crime has been perpetrated by a really sane person. Tests, both medical and legal, have been proposed. The *legal test* was explicitly stated in the following terms by the whole of the judges in conference, in answer to queries put by the House of Lords in reference to the case of *M'Naughten*, who was tried and acquitted on the ground of insanity (June 19th, 1843.)

Notwithstanding a party commits a wrong act while labouring under the idea that he was redressing a supposed grievance or injury, or under the impression of obtaining some public or private benefit, he is liable to punishment. The jury ought in all cases to be told that every man should be considered of sane mind until the contrary was clearly proved in evidence. That before a plea of insanity should be allowed, undoubted evidence ought to be adduced that the accused was of diseased mind, and that at the time he committed the act, *he was not conscious of right or wrong*. Every person was supposed to know what the law was, and therefore nothing could justify a wrong act, except it was clearly proved that the party did not know right from wrong. If that was not satisfactorily proved, the accused was liable to punishment. If the *delusion* under which a person laboured were only *partial*, the party accused was equally liable with a person of sane mind. If the accused killed another in self-defence, he would be entitled to an acquittal; but if the crime were committed for any supposed injury, he would then be liable to the punishment awarded by the laws to his crime. (B. and F. M. R., July, 1843, p. 273.)

It would appear from this, that the law, in order to render a man responsible for a crime, looks for a *consciousness of right and wrong, and a knowledge of the consequences of the act*. Thus, the complete possession of reason is not essential to constitute the legal responsibility of an offender; and it is also to be inferred, from the results of several cases, that a man may be civilly incompetent, but sufficiently sane to be made criminally responsible. The proofs required in the two cases are essentially distinct. It has very properly been objected to this *legal test*, that it is insufficient for the purpose intended: it cannot, in a large majority of cases, enable us to distinguish the insane homicide from the sane criminal. Many *insane persons* have committed acts which they knew to be wrong, and of the criminality of which they were at the time perfectly conscious. [We have heard undoubted lunatics boast that they could not be hung for the crime of murder. In one instance we were threatened by a lunatic, who reminded us that he could not be punished for killing us.—H.] They have been known

to murder others, in order to receive the punishment of death at the hands of the law; and therefore they must have been fully conscious of the wrongfulness of the act which they were perpetrating, and have known that they were committing an offence against the law of man. In short, the criminal nature of the act has often been the sole motive for its perpetration! (See the case of *Touchett*, p. 584; also case, Ann. d'Hyg. 1842, i. 363.) It has been suggested with some truth, that it is rather the imperfect or defective appreciation of the motives to right or against wrong action which leads to crime among the insane, and not the mere ignorance of right and wrong. Most lunatics have an abstract knowledge that right is right and wrong wrong, but in true insanity the voluntary power to control thought and actions is impaired, limited, or overruled by insane motives. A lunatic may have the power of *distinguishing* right from wrong, but it is contended, from a close observation of the insane, that he has not the power of *choosing* right from wrong. A criminal is punishable not merely because he has the power of distinguishing right from wrong, but because he voluntarily does the wrong, having the power to choose the right. (Jamieson's Lectures on Insanity, Med. Gaz. xlvi. p. 827.) In *Greensmith's* case (ante, p. 575,) there was no doubt that the man knew he was doing wrong and what was contrary to law; for after having murdered two of his children, he returned and murdered the others, considering that he might as well suffer for all as for two! The case of *Hadfield*, who was tried for shooting at George III. and acquitted on the ground of insanity, furnishes another striking example of the existence of insane delusion, coupled with a full knowledge of the consequences of the act which he was about to commit. He knew that in firing at the King he was doing what was contrary to law, and that the punishment of death was attached to the crime of assassination; but the motive for the crime was that he might be put to death by others,—he would not take his own life. Again, *Martin*, the incendiary, admitted that he knew he was doing wrong, according to the law of man, when he set fire to York Cathedral: he was conscious that the act was illegal, but he said he had the command of God to do it. Thus, then, we find that a full consciousness of the illegality or wrongfulness of an act may exist in a man's mind at the time of its perpetration, and yet in spite of this he may be fairly acquitted on the ground of insanity. Strangely enough, his acquittal will also meet with the concurrence of those who maintain that an *utter unconsciousness of right and wrong* is a *necessary part of the proof* before the plea of insanity can be received and the only safe test by which we can distinguish sanity from insanity in the perpetration of crime!

Medical tests.—It will now be proper to examine the *tests* which have been proposed by medical jurists for detecting these cases of homicidal mania.

1. The acts of homicide have generally been preceded by other striking *peculiarities of conduct* in the individual, often by a total change of character. 2. They have in many instances previously or subsequently attempted *suicide:* they have expressed a wish to die or to be executed as criminals.

These supposed criteria have been repeatedly and very properly rejected, when tendered as medical proofs of insanity in Courts of Law. They are of too vague a nature, and apply as much to cases of moral depravity as of actual insanity: in short, if these were admitted as *proofs*, they would serve as a convenient shelter from punishment for many sane criminals.

3. These acts are without *motive:* they are in opposition to all human motives. A man known to have been tenderly attached to his wife and children, murders them:—a fond mother destroys her infant.

Motive for crime.—It is hereby assumed or implied that sane men never commit a crime without an apparent motive; and that an insane person never has a motive, or one of a delusive nature only, in the perpetration of a criminal act. If these positions were true, it would be very easy to distinguish a sane from an insane criminal; but the rule wholly fails in practice. In the first place, the

non-discovery is here taken as a proof of the *non-existence* of a motive; while it is undoubted that motives may exist for many atrocious criminal acts without our being able to discover them—a fact proved by the numerous recorded confessions of criminals before execution, in cases in which, until these confessions were made, no motive for the perpetration of the crime had appeared to the acutest minds. In the case of *Courvoisier*, who was convicted of the murder of Lord William Russell in June, 1840, it was the reliance upon this alleged criterion, before the secret proofs of guilt accidentally came out, that led many to believe he could not have committed the crime; and the "absence of motive" was urged by his counsel as the strongest proof of the man's innocence. It was ingeniously contended "that the most trifling action of human life had its spring from some motive or other." This is undoubtedly true, but it is not always in the power of a man untainted with crime to detect and unravel the motives which influence criminals in the perpetration of murder. No reasonable motive was ever discovered for the atrocious murders and mutilations perpetrated by *Greenacre* and *Good;* yet these persons were very properly made responsible for their crimes! On the trial of *Francis* for shooting at the Queen, the main ground of the defence was, that the prisoner had no motive for the act, and therefore was irresponsible; but he was convicted. It is difficult to comprehend under what circumstances any motive for such an act as this could exist; and therefore the admission of such a defence would have been like laying down the rule, that the evidence of the perpetration of so heinous a crime should in all cases be taken as a proof of the existence of an irresponsible state of mind! Crimes have been sometimes committed without any apparent motive by sane individuals, who were at the time perfectly aware of the criminality of their conduct. No mark of insanity or delusion could be discovered about them, and they had nothing to say in their defence. They have, however, been very properly held responsible. On the other hand, lunatics confined in a lunatic asylum have been known to be influenced by motives in the perpetration of crimes. Thus they have often murdered their keepers in revenge for ill treatment which they have experienced at their hands. (See the case of The *Queen* v. *Farmer*, York Spring Assizes, 1837.) This man was acquitted as insane, while the clear motive for the homicide was revenge and ill feeling. In another case the act of murder was perpetrated from jealousy. (*Reg.* v. *Goule*, Durham Summer Ass. 1845.) On the whole, the conclusion with respect to this assumed criterion is, that an absence of motive may, when there are other strong evidences of insanity, favour the view of irresponsibility for crime; but the non-discovery of a motive for a criminal act cannot of itself be taken as any proof of the existence of homicidal monomania in the perpetrator. It is right to state, however, that the law invariably acts on this humane principle;—the absence of a sufficient motive affords a strong presumption of innocence,—the presence of one is no proof of guilt.

4. The subsequent conduct of the individual:—he seeks no *escape*, delivers himself up to justice, and acknowledges the crime laid to his charge.

Confession.—This is commonly characteristic of homicidal mania: for by the sane criminal every attempt is made to conceal all traces of the crime, and he denies it to the last. A case occurred in September, 1843, which, however, shows the fallacy of this criterion. A man named *Dadd*, murdered his father at Cobham, under circumstances strongly indicative of homicidal mania: he fled to France after the perpetration of the crime, and was subsequently tried and acquitted on the ground of insanity. (See also, another case, Ann. d'Hyg. 1829, ii. 392.) On the other hand, it must be remembered that sane persons who destroy the lives of others through revenge or anger, often perpetrate murder openly, and do not attempt to deny or conceal the crime; for they know that denial or attempt at concealment would be hopeless. Again, a morbid love of notoriety will often induce sane criminals to attempt assassination under circumstances where the attempt must necessarily be witnessed by hundreds, and there

can be no possibility of escape. The attacks made upon the life of the Queen are sufficient to bear out this statement.

5. The sane murderer has generally *accomplices* in vice or crime; the homicidal monomaniac has not.

Accomplices.—Upon this it may be observed that some of the most atrocious murders committed in modern times, as those perpetrated by *Greenacre, Good, Courvoisier,* and others, were the acts of solitary individuals, who had neither accomplices nor any assignable inducements leading to the commission of the crimes. It is, however, a fact so far in favour of the existence of homicidal insanity, that the *insane* never have accomplices in the acts which they perpetrate. These criteria can hardly be described as medical; they are circumstances upon which a non-professional man may form just as safe a judgment, as one who has made insanity a special study.

Delusion in the act.—The presence of *delusion* has been said to characterize an act of homicidal monomania, while premeditation, precaution and concealment, have been considered the essential features of the act of a sane criminal. With respect to delusion, it has been decided that the mere proof of the existence of this does not excuse the act: if the delusion be *partial,* the party accused is still responsible;—and if the crime were committed for an imaginary injury, he would be held equally responsible. (See ante, p. 577.) Much stress was formerly laid upon the *delusion being connected with the act* in cases of insanity; but it must be remembered that, except by the confessions of insane persons during convalescence, it is not commonly easy for a *sane mind* to connect their most simple acts with the delusions under which they labour. Every act of homicide perpetrated by a really insane person is doubtless connected with some delusion with which he is affected; but it by no means follows, that one who is sane should always be able to make out this connexion; and it would be therefore unjust to rest the irresponsibility of the accused upon an accidental discovery of this kind. Let the following cases show how little a sane person is able to connect the delusions of the insane with their acts. Marc mentions that a patient of his was continually in the habit of licking the plaster from the walls of his cell,—in some places they had been licked quite bare by this disgusting practice. It was only accidentally discovered that the act was connected with a delusion, under which the man laboured, that he was licking and tasting the most delicious fruits! Another patient was in the habit of running up and down the ward, beating his own shadow with a stick. It turned out that he fancied this shadow to be an army of rats in constant pursuit of him! As having closer reference to the present subject, I may refer to the case of a young man, upon whom an inquisition was held in 1843. He was a person of mild manners, and he laboured under a delusion connected with windmills. He would go any distance to see a windmill, and would sit watching one for days together. His friends removed him to a place where there were no mills, in the hope that this strange propensity would wear away. He enticed a child into a wood, and in attempting to murder it, cut and mangled its limbs with a knife in a horrible manner. How would any sane person have connected this delusion respecting windmills with attempted murder? Yet it turned out that he had taken the resolution to commit this horrible crime, in the hope that he should be removed as a punishment to some place where there would be a mill! (See Report on Lunatics, Quart. Rev., 1844.) Lord Erskine's doctrine in *Hadfield's* case is therefore, medically speaking, wholly untenable. The connexion of delusion with the act may exculpate an accused party; but the non-establishment of this connexion proves nothing. It may be further observed, that premeditation and precaution are met with in crimes committed both by sane and insane criminals; although these, with subsequent concealment, are certainly strong characteristics of sanity. It is also a question, whether, when they are proved to have existed in any criminal act, there might not have been such a power of self-control in

the individual, although in some degree insane, as to justify the application of punishment. Are such individuals less beyond the influence of example than one-half of the sane criminals who are punished?

Summary.—The foregoing considerations lead to the inference, that there are *no certain legal or medical rules*, whereby homicidal mania can be detected. Each case must be determined by the circumstances attending it: but the true test for irresponsibility in these ambiguous cases appears to be, whether the individual, at the time of the commission of the crime, had or had not a *sufficient power of control to govern his actions.* If from circumstances it can be inferred that he had this power, whether his case may fall within the above rules or not, he should be made responsible and rendered liable to punishment. If, however, he was led to the perpetration of the act by an *uncontrollable* impulse, or, in other words, by an impulse which his mental condition did not allow him to control, (lésion de volonté, Esquirol,) whether accompanied by deliberation or not, then he is entitled to an acquittal as an irresponsible agent. The power of controlling an act appears to me to imply the existence of such a state of sanity as to render the party responsible. It has been objected that such a rule would not include all cases of *intellectual* insanity; but the proof might then be derived from other sources, such as the existence of delusion, or insane conduct. In the mean time the rule is applicable to those cases in which it is most required, *i. e.* of moral insanity; and in one instance there were no other facts upon which a verdict could be founded. (*Reg.* v. *Brixey*, C. C. C., May, 1845, p. 584.) A test somewhat similar to this is constantly applied by juries, under the direction of our judges, to distinguish murder from manslaughter; and it is quite certain that sanity and homicidal mania are not more nicely blended, than are occasionally the shades of guilt whereby manslaughter passes into murder. The manner and circumstances under which a crime is committed will often allow a fair inference to be drawn as to how far a power of self-control existed or was exercised. A man in a violent fit of mania rushes with a drawn sword into an open street, and stabs the first person whom he meets;—another, worn out by poverty and destitution, destroys his wife and children to prevent them from starving, and then probably attempts to murder himself,—these are cases in which there is fair ground to entertain a plea of irresponsibility; but when we find a man (*Reg.* v. *M'Naughten*) lurking for many days together in a particular locality, having about him a loaded weapon,—watching a particular individual who frequents that locality,—a man who does not face the individual and shoot him, but who coolly waits until he has an opportunity of discharging the weapon unobserved by his victim or others,—the circumstances appear to show such a perfect adaptation of means to ends, and such a power of controlling his actions, that one is quite at a loss to understand why a plea of irresponsibility should be admitted except upon the fallacious ground, that no motive could be discovered for the act,—a ground, however, which was not allowed to prevail in the cases of Courvoisier, Francis and the perpetrators of other atrocious crimes!

Test of irresponsibility.—There is no novelty in the test here proposed; it is more or less advocated by Esquirol, Marc, Ray, Pagan, Jamieson, and the best writers on the medical jurisprudence of insanity. Esquirol describes three forms of homicidal monomania: 1, depending on aberration of intellect; 2, on perverted moral feelings; 3, on diseased volition depriving the individual of his moral liberty, *i. e.* the power of controlling his actions (impuissance de la volonté qui prive l'homme de sa liberté morale.) (Mal. Mentales, ii. 842.) M. Marc adopts throughout the opinions of Esquirol. (De la Folie, ii. 71.) Dr. Ray, an intelligent American writer, considers that all forms of homicidal monomania are characterized by an "*irresistible* motiveless impulse to destroy life;" (Med. Jur. of Insanity, 268;) and Dr. Pagan properly observes,—"The very loss of the *control over our actions* which insanity infers, is that which renders the acts which are committed during its continuance undeserving of punishment." (Med. Jur.

of Insanity, 211.) The test should be, according to Dr. Jamieson, "had the lunatic at the time of committing the deed a knowledge that it was criminal, and *such a control* over his actions, as ought, if exerted, to have hindered him from committing it." (Med Gaz. xlvi. p. 827.) Thus, then, it would appear from the concurrent views of medico-legal writers and of the most experienced practical observers of the habits and conduct of the insane, that we have here the true criterion whereby the responsibility or irresponsibility of an accused party ought to be tested; and although there will be some difficulty in determining how far the individual did or did not possess control over his act;—whether the impulse was or was not irresistible, (impuissance de la volonté;) yet it must be borne in mind that the same objection applies with equal force not only to the present legal test, (the existence or non-existence of a *consciousness of right or wrong* under which persons are yearly acquitted or executed,) but to every test or rule, medical or legal, that has hitherto been proposed by physician or jurist.

Cases in illustration.—It is well known that individuals seized with a desire to kill, have been able, in some instances, to exercise a certain degree of control over the impulse, and have thus saved the lives of their intended victims, and themselves from the imputation of a heinous crime. Among many cases of this description to be found in medico-legal works, there is perhaps none which illustrates the statement more forcibly than the following by Mr. Daniell. A patient labouring under disordered liver, without any sign of intellectual aberration, was found by him to be on one occasion in a state of great excitement. He confessed that whilst talking with his wife and family, his eye caught the poker,—a desire to shed blood came upon him which he felt he could not control. He shut his eyes and tried to think of something else, but it was of no use. At last, he could bear it no longer, and with a voice of thunder he ordered them out of the room. Had they opposed him, he felt he must have murdered them all. (Prov. Med. Jour. Nov. 12, 1845.) This was a sudden fit of homicidal monomania, and it presents a fearful picture of the contending feelings which agitate an individual labouring under it. There was here, it will be observed, not an entire deprivation of self-control, or he would have attacked his wife and children without giving them any warning. (For other cases, see Esquirol, Maladies Mentales, ii. 807.)

Much difference of opinion existed relative to the case of *M'Naughten*, who was tried for the murder of *Mr. Drummond* (Jan. 7, 1843,) and acquitted on the ground of insanity. There is hardly a doubt, that had the deceased given any personal offence to this individual before the perpetration of the act, he would have been convicted; if the deceased, from feeling annoyed at his following him, had struck him or pushed him away before the pistol was fired, it is most probable that the plea of insanity would not have been received. In the acquittal of this man, it is evident that considerable importance was attached to the non-discovery of a motive; for had any kind of motive been apparent, it is certain that an alleged "homicidal climax," *occurring at the particular moment when the deceased's back was turned*, and after several days' watching on the part of the assailant, would not have been admitted as a sufficient exculpatory plea! If we except the case of *Oxford*, tried for shooting at the Queen, there is perhaps no case on record in English jurisprudence where the facts in support of the plea of insanity were so slight; and when the cases of *Bellingham*, *Lees*, and *Cooper* are considered, the two latter tried and executed within the last few years, it must be evident that there are both uncertainty and injustice in the operation of our criminal law. Either some individuals are most improperly acquitted on the plea of insanity, or others are most unjustly executed. If the punishment of death were abolished, there is no doubt that less would be heard of this plea; but in the mean time, it is unfortunate that there is no other way of avoiding capital punishment, than by striving to make it appear that the criminal is insane! (See Prichard, 399.) It is on this point that medical witnesses seem to

me to lose sight of their true position. In giving an opinion of the mental condition of an offender, it is no part of their province to model that opinion according to the *punishment* which may follow if the plea be rejected, but according to the *facts* of the case. The Legislature only is responsible for the punishment adjudged to crimes. It is certainly a great evil, that under the present mode of laying the question before a jury, the law operates most unequally. One case becomes a subject of prominent public interest, and every exertion is made to construe the most trivial eccentricities of character into proofs of insanity: an acquittal follows. Another case tried at the assizes may excite no interest,—it is left to itself,—the accused is convicted, and either executed or otherwise punished; although the evidence of insanity, had it been as carefully sought for and brought out, would have been as strong in this as in the former instance (*Reg.* v. *Stolzer*, Cent. Crim. Court, Nov. 1843; also *Reg.* v. *Laurence*, Lewes Lent Ass. 1844, infra.) That this kind of defence has, however, been carried too far, will be apparent from the observation of Mr. Baron Gurney in the case of The *King* v. *Reynolds*, where this learned judge said that "the defence of insanity had lately grown to a fearful height, and the security of the public required that it should be watched." So also Mr. Justice Coltman, in the case of The *Queen* v. *Weyman*, remarked, "that the defence of insanity was one which was to be watched with considerable strictness, because it was not any slight deviation from the conduct which a rational man would pursue under a given state of circumstances, which would support such a line of defence." When the punishment attached to an offence is not capital, it would appear that much stronger evidence is required to establish a plea of insanity than under other circumstances. This will be seen by reference to the case of The *Queen* v. *Grove* (Stafford Lent Assizes, 1842.) The evidence of insanity was considerably stronger than that adduced in the case of *M'Naughten;* yet the prisoner was convicted! These two cases occurring so recently, the one after the other, display the great uncertainty attendant upon a plea of this kind. So, again, it would be difficult to reconcile, upon *medical* grounds, the conviction of *Francis* with the acquittal of *Oxford*, both of them tried for the same crime (shooting at the Queen,) committed under similar circumstances. In the case of The *Queen* v. *Stolzer* (Cent. Crim. Court, Oct. 1843,) where the charge was one of murder by stabbing, the plea was rejected, although no motive appeared, and there were some indications of insanity. In another case (The *Queen* v. *Rowe*,) tried at the same time, the prisoner, an old man, deliberately fired a loaded pistol at his master, because he had discharged him from his service and would not take him back. There was no mark of insanity either in the act or in his previous conduct, but he was acquitted as insane, on the lenient presumption that he might be labouring under the imbecility of age!

The case of *Reg.* v. *Laurence* (Lewes Lent Ass. 1844,) affords a remarkable contrast to that of *M'Naughten*. The prisoner had been arrested by a constable for a petty theft: he was taken to the police-station, where the inspector, who was an utter stranger to him, was at the time engaged in talking to some friends, his back being turned to the prisoner. The man suddenly seized a poker and struck the inspector a violent blow on the skull, from which he speedily died. The prisoner admitted that he struck the blow; that he had no motive for the act; and that he would have struck any one else who had been standing there at the time. He also said he hoped the deceased would die; he was glad he had done it, and he wished to be hanged. The evidence at the trial showed that there was no cause of quarrel between the parties, but that the prisoner appeared to be actuated by some *sudden impulse*, for which not the slightest reason could be assigned. This man was left to a chance defence, for the Court was actually obliged to assign counsel to him. There was no eloquent advocate, to make a brilliant speech in his favour; there were no medical witnesses, profoundly versed in the subject of insanity, to contend for the existence of a "homicidal climax,"

or of impulsive homicidal monomania; but there was simply a formal plea of insanity, resting upon the fact of the deceased being a stranger to him, and of there being, consequently, no motive for the act of murder. The jury negatived this plea, and the prisoner was convicted and executed! The differences between this case and that of *M'Naughten*, were, that there was in *Laurence* less evidence of deliberation, with stronger evidence of sudden impulse; and there was not sufficient interest about the deceased, the prisoner, or his crime, to attract any great public attention!

This case had not long occurred, when another of a similar kind was the subject of a trial at the Central Criminal Court (*Reg.* v. *Hon. Ross Touchett*, October, 1844.) The prisoner, a young man, entered a shooting gallery in Holborn, took up a pistol, and deliberately fired at the proprietor of the gallery while his back was turned, thereby inflicting a wound which ultimately led to his death, after the long period of eleven months. The prisoner was tried for shooting with intent to murder. The defence was insanity, founded on the absence of motive for the act and on the presumption of hereditary taint. After having fired the pistol the prisoner said he did it on purpose, for he wished to be hanged. This was no evidence of *intellectual* aberration: his landlady said he was a very regular and quiet person, and that he had complained of a sensation of boiling at the top of his head! Dr. Monro considered that at the time of the act the prisoner was labouring under mental derangement. He admitted to him that he had no knowledge of Mr. Smith (the person whom he shot,) but that he wished to be hanged, and had been brooding over suicide for some years. He referred to the case of *Laurence*, who had killed a man at Brighton (supra,) and said that he wished to do something of the same kind, in order to get himself hanged. He was acquitted on the ground of insanity. What distinction can possibly be made by physician or jurist between these two cases,—or how is it possible to lay down rules for the future guidance of medical witnesses under such capricious decisions? The acquittal of *Touchett* may have been perfectly right; but then the conviction and the execution of *Laurence* was a public wrong.

The principles of the English law have been closely scrutinized not only by medico-legal writers, but by men who have had long experience in the management of the insane, and who have made themselves well acquainted with their habits; and it has been abundantly proved, that the test of responsibility assumed by it is of a purely theoretical kind, and cannot be carried into practice. With this admission, it appears to me unnecessary to occupy space with metaphysical discussions regarding criminal responsibility; for however defective the rules, if the *practice* of the law be in any one case in conformity with that which has been advised by the best writers on the medical jurisprudence of insanity, although it may be adverse to the theory on which it is professedly based, this is all with which we have to concern ourselves: the principle is admitted. The great defect in the English law is, not that it will not go to the full extent of the doctrine of moral sanity, or of "uncontrollable impulse," (case of *Touchett*,) but the *uncertainty of its application* (case of *Laurence*.) The cases referred to show that an acquittal on the plea of insanity is left to be a mere matter of accident.

Among a large number of cases which have occurred within a recent period, I shall select one, because it shows plainly that the law makes no difficulty in admitting the plea of insanity,—even when it depends on perverted moral feeling only, or on "*irresistible impulse*." The most strenuous advocate of irresponsibility in cases of moral insanity, can desire no better precedent than that furnished by the case of *Reg.* v. *Brixey* (Central Crim. Court, June, 1845.) The prisoner was a quiet, inoffensive girl, a maid-servant in a respectable family. She had laboured under disordered menstruation, and, a short time before the occurrence, had shown some violence of temper about trivial domestic matters. This was all the evidence of her alleged insanity—the rest was furnished by the

act of murder, a species of evidence which is not generally considered to be admissible. She procured a knife from the kitchen on some trivial pretence, and while the nurse was out of the room, cut the throat of her master's infant child. She then went down stairs, and told her master what she had done. She was perfectly *conscious* of the crime she had committed, and showed much anxiety to know whether she would be hanged or transported. There was not the slightest evidence that she was labouring under any delusion, or any intellectual aberration whatever. The prisoner was acquitted on the ground of insanity, probably caused by obstructed menstruation. (See Med. Gaz. xxxvi. 166, 247.) In trying this case by the medical rules laid down for detecting homicidal monomania (ante, p. 578,) we shall see that it falls under the 3d, 4th, and 5th only; *i. e.*, absence of motive,—no attempt to escape,—no accomplices. Admitting the probability of a connexion existing between amenorrhœa and insanity in the abstract, there was no more proof of insanity in the case of this girl than in that of *Laurence;*—yet one was convicted and executed, while the other was acquitted! In the defence of *Brixey*, Mr. Clarkson uttered a plain medical and legal truth, in stating that "*no general rules can be applied to cases of this sort.* Each case must be decided by the peculiar facts which accompany it." Notwithstanding the precedent furnished by this case, and another of a similar kind, *Reg.* v. *Stowell* (Med. Gaz. xlvii. p. 569,) the Court will commonly look for some clear and distinct proof of mental delusion or *intellectual* aberration. If there be no proof of delusion or of weakness of intellect on the part of the accused, the plea of homicidal insanity from irresistible impulse may still be rejected. In the case of *Reg.* v. *Burton* (Huntingdon Summer Assizes, 1848,) the prisoner was indicted for the murder of his wife, by cutting her throat. It appeared that he had no motive for killing her,—that he had been previously unwell, and restless at night,—that he did not attempt to conceal or deny the commission of the crime, and that he expressed no sorrow or remorse for it when perpetrated. The medical witness attributed the act to a sudden homicidal impulse: the prisoner's reason was not affected, and he had not laboured under delusions. This appears to have been a proper view of the case. The learned judge dissented from the medical opinion, because the excuse of an irresistible impulse, co-existing with the full (?) possession of reason, would justify any crime whatever. It must be remembered, however, that the plea of an irresistible impulse could not be made when any *motive* appeared for the act. There appears to have been no stronger reason for convicting this prisoner than for convicting Brixey. The jury, nevertheless, found him guilty, while Brixey was acquitted!

Numerous criminal trials, involving the plea of insanity in cases of murder, have taken place of late years. Among these may be particularly specified the cases of *Reg.* v. *Johnstone* (see Med. Gaz. xxxvii. p. 421,) *Reg.* v. *Ovenston* (Journal of Psychol. Med. 1848, p. 169,) *Reg.* v. *Allnutt* (Journal Psychol. Med. 1848, p. 193,) and *Reg.* v. *Parker.* In the first two, the prisoners were acquitted on the ground of insanity; although I quite agree with Dr. Mayo, in thinking that in Johnstone's case there was not the slightest proof of insanity. (Clinical Facts, 208.) In the case of *Reg.* v. *Allnutt,* the prisoner, a boy aged 12, was convicted of poisoning his grandfather, under circumstances indicative of great contrivance and deliberation. The medical evidence entirely failed to show that the prisoner was insane, and he was convicted. The remarks made by the judge who tried this case (Rolfe, B.) are of some importance in relation to this plea. "The witnesses called for the defence had described the prisoner as acting from uncontrollable impulse, and they had made other statements, of the value of which it would be for the jury to decide; but he must say that it was his opinion that such evidence ought to be scanned by juries with very great jealousy and suspicion, because it might tend to the perfect justification of every crime that was committed. What was the meaning of not being able to resist moral influence? Every crime was committed under an influence of such a de-

scription, and the object of the law was to compel persons to control these influences; and if it was made an excuse for a person who had committed a crime, that he had been goaded to it by some impulse, which medical men might choose to say he could *not* control, he must observe that such a doctrine would be fraught with very great danger to society." The reader will do well to consult Dr. Mayo's remarks on this subject. (Clinical Facts, 1847, p. 198; also in Med. Gaz. xxxvii. p. 421, and Journal of Psychol. Med. 1848, p. 609. See cases in Med. Gaz. xlii. p. 255; and *Reg.* v. *Clarke*, Norfolk Lent Assizes, 1851; *Reg.* v. *Monkhouse*, C. C. C., Dec., 1849; and *Reg.* v. *Arnold*, Aylesbury Lent Assizes, 1850.)

It cannot be denied that the doctrine of "irresistible impulse" has been carried in recent times to such an extent as to create a great distrust of medical evidence on these occasions. It is obviously easy to convert this into a plea for the extenuation of all kinds of crime for which motives are not apparent, and thus medical witnesses often expose themselves to severe rebuke. They are certainly not justified in setting up such a defence, unless they can draw a clear and common sense distinction between impulses which are resistible and those which are irresistible.

In the case of *Reg.* v. *Pate*, tried in 1850 at the Central Criminal Court, the prisoner was indicted for an assault on the Queen. It was proved that he had been guilty of strange and eccentric conduct, but there was no evidence to show that he had not a reasonable control over his actions. Dr. Conolly admitted that the prisoner was labouring under no delusion, that he knew the distinction between a right and a wrong action, but was subject to impulses of passion. He attributed his act to some sudden impulse which he was quite unable to control. Other witnesses deposed that in their opinion, although the prisoner was fully conscious of his act, he was insane. The learned judge (Baron Alderson) who tried the case observed, in charging the jury, that it was not because a man was insane that he was unpunishable; and he must say upon this point there was generally a very grievous delusion in the minds of medical men. "The only insanity which excused a man for his acts was that species of delusion which conduced and drove him to commit the act alleged against him. They ought to have proof of a formed disease of the mind, a disease existing before the act was committed, and which made the person accused incapable of knowing, at the time he did the act, that it was a wrong act for him to do." The jury convicted the prisoner, and he was sentenced to transportation. (Med. Gaz. xlvi. p. 152; and Journ. Psychol. Med. 1850, p. 557.) The plea of insanity was here advanced upon very weak grounds. Had the prisoner assaulted a policeman instead of the Queen, he would have been fined or imprisoned, and nothing heard of the plea, although the rank of the person assaulted can make no difference respecting the existence or non-existence of a diseased state of mind. (See some excellent remarks on this case by Dr. Forbes Winslow, Journal Psychol. Med. 1850, p. 445.)

From the summing up of the learned judge, it would appear that the existence of one degree of insanity would admit of punishment for crime, while the existence of another degree would excuse it. As it has been already remarked in speaking of testimonial capacity, nothing can be more absurd than to apply one general term "insanity" to the condition of all persons affected with mental disorder, and to pronounce them therefore all incompetent or all incapable, when common sense suggests that we are bound to inquire into the amount of capacity in each case. If all persons are to be excused from responsibility for crimes or offences, because they entertain certain delusions, or are guilty of eccentricity, it would be better at once to make one general rule, and render all their civil acts void, and at the same time give them the benefit of irresponsibility for any criminal acts, without inquiring into the degree in which insanity exists. Such a practice would hardly be compatible with the due exercise of justice, or with the safety of society.

Dr. Wood, who has lately written on this subject, repudiates the doctrine that an insane person is necessarily irresponsible, and therefore unpunishable. "All who have had the opportunity of studying insanity, know full well that with comparatively few exceptions, insane persons are not only powerfully influenced, but materially controlled, by the same motives which influence and control those who are still mixing in the world, and who have never been suspected of mental derangement." (Plea of Insanity, 1851, p. 4.)

The great difference of opinion which exists between physicians and jurists in reference to this plea, appears to me to consist in this:—Jurists aver that no degree of insanity should exempt from punishment for crime, unless it has reached that point *that the individual is utterly unconscious of the difference between right and wrong at the time* of committing the alleged crime. (See paper by Mr. Warren, op. cit.) Physicians aver that this is really no test of the existence of insanity; that those who are labouring under confirmed insanity, and who have been confined in asylums for years, are fully conscious of the difference between right and wrong, and are quite able to appreciate the consequences of their acts. Again, those who have patiently watched the insane for years, agree that the legal test of utter unconsciousness of right and wrong in the performance of acts, would in reality apply only to persons who were suffering from delirium—from a furious paroxysm of mania, or from confirmed idiocy; and that if the rule suggested by Mr. Warren,—that a person, in order to be acquitted on the ground of insanity, should be proved to be as *unconscious* of his act *as a baby*,—were strictly carried out, there is scarcely an inmate of an asylum who happened to destroy a keeper or attendant, who would not be convicted and executed for murder. Such a rule amounts to a *reductio ad absurdum:* it would abolish all distinction between the sane and insane, and would consign to the same punishment the confirmed lunatic and the sane criminal. This species of *baby unconsciousness of action* exists in idiots as in furious maniacs; but not in the majority of lunatics; and it may be safely asserted, that if this criterion be the true one, acquittals on the ground of insanity have involved a series of gross mistakes for the last fifty years. The only irresponsible lunatics, according to Mr. Warren, are precisely those who would not even have reason enough to plead to an indictment. Thus while the medical profession is condemned for adopting opinions which would lead to the acquittal of criminals, the writer recommends a rule which would certainly lead to the execution of the greater number of confirmed lunatics charged with acts of homicide. The practical failure of such a rule is manifest, when it is found that persons are frequently and justly acquitted who have destroyed life with a full and perfect consciousness of the wrongfulness of their acts. (See ante, p. 584.) In the case of *Dadd*, who was acquitted on the ground of insanity, and who was proved to be a confirmed lunatic, it transpired that the man had actually provided himself with a passport and fled to France after destroying his father! (See Wood on the Plea of Insanity, p. 41.)

Having pointed out these inconsistencies, it is only proper to acknowledge that in *theory* the English law would punish a lunatic just as it would punish a sane man, provided the lunatic "had that degree of intellect which enabled him to know and distinguish between right and wrong; if he knew what would be the effects of his crime, and consciously committed it; and if with that consciousness he wilfully committed it." In *practice*, however, it is placed beyond doubt that some who ought to be held responsible are improperly acquitted, on the legal fiction that they were unconscious of the wrongfulness of their acts. Dr. Wood states, that of thirty-three males now confined as lunatics in Bethlem, who have actually committed murder, not including those where an unsuccessful attempt was made to perpetrate the same crime, *three* are reported sane; and he feels quite satisfied that two of these were *not insane* at the time they committed the murders; and of the fifteen females who have actually committed murder; five are reported sane, and two of them ought, in his judgment, never to have been acquitted on the ground of insanity. (Plea, p. 50.) These facts, then,

are sufficient to show that the rule of law generally adopted does not err on the side of severity. The only complaint that can be made is that it operates with inconsistency and uncertainty.

Summary of medical evidence.—A strange and unaccountable notion prevails in the public mind, that a homicidal lunatic is to be distinguished from a sane criminal by some *certain* and invariable symptoms or characters, which it is the business of a medical witness to display in evidence, and of a medico-legal writer to describe. But a perusal of the evidence given at a few trials will surely satisfy those who entertain this notion, that each case must stand by itself. It is easy to classify homicidal lunatics, and say that in one instance the murderous act was committed from a motive; *i. e.* revenge or jealousy;—in a second, from no motive, but from irresistible impulse;—in a third, from illusion or delusive motive; *i. e.* mental delusion;—in a fourth, from perverted moral feeling. This classification probably comprises all the varieties of homicidal insanity, but it does not help us to ascertain, *in a doubtful case*, whether the act was or was not committed under any of these psychological conditions. It will enable us to classify those who are *acquitted* on the ground of insanity, but it entirely fails in giving us the power to distinguish the sane from the insane criminal.

According to M. Esquirol, whose views, more or less modified, are adopted by all writers on the medical jurisprudence of insanity, the facts hitherto observed indicate *three degrees* of homicidal monomania:—

1. In the first the propensity to kill is connected with absurd motives or *actual delusion*. The individual would be at once pronounced insane by every body. Cases of this description are not uncommon, and they create no difficulty whatever. The accused are rarely allowed even to plead to the charge.

2. In the second class, the desire to kill is connected with *no known motive*. It is difficult to suppose that the individual could have had any real or imaginary motive for the deed. He appears to be led on by a blind impulse (Case by Mr. Daniell, ante, p. 582.)

3. In the third class, the impulse to kill is *sudden*, instantaneous, unreflecting and *uncontrollable* (*plus forte que la volonté.*) The act of homicide is perpetrated without interest, without motive, and often on individuals who are most fondly loved by the perpetrator. (Maladies Mentales, ii. 834.)

These three forms differ from each other only in degree;—the first two being strongly analogous to, but lighter modifications of the third. All the cases which came before M. Esquirol had these features in common:—an irritable constitution, great excitability—singularity or eccentricity of character; and previously to the manifestation of the propensity, there was a gentle, kind, and affectionate disposition. As in other forms of insanity, there was some well marked *change of character* or in the mode of life. The period at which the disorder commenced and terminated could be easily defined, and the malady could be almost always referred to some moral or physical cause. In two cases it was traced to the result of puberty, and in four to the power of imitation. Attempts at suicide preceded or followed the attack; all wished to die, and some desired to be put to death like criminals. In none of the cases was there any motive for the act of homicide.

M. Esquirol believes that there are well marked distinctions between this state and that of the sane criminal. Among these he enumerates, 1st, the want of accomplices in homicidal monomania. 2d, the criminal has *always* a motive—the act of murder is only a means for gratifying some other more or less criminal passion; and it is almost always accompanied by some other wrongful act: the contrary exists in homicidal monomania. 3d, the victims of the criminal are those who oppose his desires or his wishes; the victims of the monomaniac are among those who are either indifferent, or who are the most dear to him—4th, the criminal endeavours to conceal, and if taken, denies, the crime: if he confesses it, it is only with some reservation, and when circumstances are too

trong against him; but he commonly denies it to the last moment. It is the everse with the monomaniac. The exceptions to which these characters are pen have been already considered (ante, p. 579.) They have, undoubtedly, reater value in their united than in their individual application, and when in ny case they co-exist, there is strong reason to believe that the accused party is rresponsible. The great difficulty in these cases is to distinguish *moral depravity* from *insanity*. I quite agree with an excellent medico-legal writer on his subject, that "no hideousness of depravity can amount to proof of insanity, unsupported by evidence of a judgment incapacitated, or a will fettered by disease. In those cases of mental disorder in which the emotions are perverted, and where there is no clear proof of *deranged intellect*, cases which do from time to time occur, the presumption of insanity in regard to a criminal action has to be upheld by evidence of suspension of the will," (Jamieson's Lectures on the Med. Jur. of Insanity, Med. Gaz. xlviii. p. 181.) But it is not possible in many cases to produce satisfactory evidence of the suspension of the will: this suspension can only be *assumed* from the act, which is admitted to be a dangerous assumption, and one that might lead to the confusion of crime with insanity. In subsequent lectures this writer describes the various conditions under which it would be reasonable to consider homicide as an act of insanity (Vol. xlvi. pp. 527 and 827.) Those cases are included in which "the action was motiveless,—the manifestation of a blind irresistible impulse, inconsistent with the natural tendencies of the individual, and indicating in its circumstances the temporary existence of a delirious loss of control," although no *intellectual* derangement may be obvious. The insanity is obviously in such cases assumed to exist.

[The absence of motive, unless there is some other and better evidence of insanity, ought rather to be considered an aggravation of the crime. We agree with Dr. Wood (ante, p. 587,) in the belief that the doctrine which releases the insane from responsibility and consequent liability to punishment for criminal acts, is unsound and dangerous when applied to many cases. In the present state of our knowledge, however, it would be even more difficult to make the true distinction between responsible and irresponsible lunatics than it now is to make that between the sane and insane. Indeed the whole question of responsibility is yet in a most unsatisfactory position, and the plea of insanity is so liable to abuse, that a natural regard for the safety of the community requires that in murder cases, it should never be allowed without an enforcement of the alternative of imprisonment or secure confinement for life.—H.]

Medical opinions.—Some doubt has existed, whether a medical witness, on a trial in which the plea of insanity is raised, could be asked his opinion respecting the state of the prisoner's mind at the time of the commission of the alleged crime,—whether the accused was conscious at the time of doing the act that he was acting contrary to law, or whether he was then labouring under any and what delusion. It has been now decided, by fourteen judges out of fifteen, that facts tending to lead to a strong suspicion of insanity must be proved and admitted, before the opinion of medical witnesses can be received on these points. (See Med. Gaz. xlvi. p. 240.)

["No defence," says Dr. Griffith in the last edition, "in cases of trial for murder has been more frequent or more successful of late years in our courts than that of insanity on the part of the prisoner. Juries appear to have considered that the adage of 'ira est dementia brevis' should be allowed its fullest signification, and be taken as an excuse for any act of violence. The true grounds are those stated by the judges as quoted in the text, and they should be closely enforced in all cases. If our law, as in England, ordered the restraint and reclusion of a prisoner acquitted of crime on the plea of insanity, it would matter little which verdict was given; but when, as in the case here, the prisoner is acquitted on the score of alleged insanity and permitted to go at large, the public have a right to demand why, if wilfully and knowingly criminal, he is allowed

to escape unpunished; and why, if insane, he is let loose to commit other acts of violence with impunity. The plea has been, that as long as the law awards death as the punishment for murder, every thing should be allowed in favour of the accused. This is founded on humane feelings, no doubt, but is morally wrong. Much of the evil is attributable to the medical practitioners called as witnesses in these cases; for, as they are aware, if they declare that the accused is sane, they destroy his last hopes of safety, they manage, without stating that the prisoner is absolutely insane, to leave an impression on the minds of the jury that he was not an accountable being at the time of the commission of the crime." We entirely agree with the views expressed in the foregoing note of Dr. Griffith, and are glad to perceive that they are beginning to prevail much more generally than at the date of the doctor's writing. The real desideratum is a law requiring dangerous lunatics to be permanently confined.—H.]

It is proper that a medical witness should remember, in examining an accused party, who is alleged to have committed a crime while labouring under insanity, that the plea may be good, and yet the individual be *sane* when examined. This was observed in the case of a lunatic, who killed his mother, in February, 1843. There was no doubt that he was insane at the time of the act; but two days afterwards he was found to be of a perfectly sound mind. This sudden restoration to reason is sometimes met with in cases of homicidal mania. For a remarkable case of this description, where the motive for a man killing his wife was apparently jealousy, see report by MM. Leuret and Ollivier. (Ann. d'Hyg. 1843, ii. 187; also, 1836, ii. 122.) Lord Hale mentions a case, where a woman soon after her delivery killed her infant. She confessed the crime, was carried to prison, fell into a deep sleep, wakened quite sane, and wondered how she came there. (See also the case of *M'Callum*, Alison, 650.)

CHAPTER LXIX.

SUICIDAL MANIA—SUICIDE NOT NECESSARILY INDICATIVE OF INSANITY—SUICIDE A FELONY—IN RELATION TO LIFE-INSURANCE—HEREDITARY TAINT—PUERPERAL MANIA—PYROMANIA—KLEPTOMANIA—DRUNKENNESS—CIVIL AND CRIMINAL RESPONSIBILITY OF DRUNKARDS—ILLUSIONS—RESTRAINT—INTERDICTION—DELIRIUM TREMENS—SOMNAMBULISM—CIVIL AND CRIMINAL LIABILITIES OF THE DEAF AND DUMB.

SUICIDAL MANIA.

Suicide not necessarily indicative of insanity.—In monomania, especially in that form which is called melancholia or lypemania, there is often a strong propensity to the commission of suicide. This may proceed from sudden impulse or from delusive reasoning. Suicidal mania is susceptible of being spread by imitation, more especially when the mode of self-destruction adopted is accompanied by circumstances of a horrible kind, or exciting great notoriety. The sight of a weapon or of a particular spot where a previous suicide has been committed, will often induce a person, who may have been hitherto unsuspected of any such disposition, at once to destroy himself. In some instances an individual fancies that he is oppressed and persecuted, that his prospects in life are ruined, when, on the contrary, his affairs are known to be flourishing. He destroys himself under this delusion. In cases of this description, whether arising from a momentary insane impulse or from delusive reasoning, there cannot be a doubt that the act is one of insanity. It is very different, however, where a real motive is obviously present,—as where an individual destroys himself to avoid disgrace or impending ruin, because here the results are clearly foreseen, and the suicide calculates that the loss of life would be a smaller evil than the loss of honour

and fortune. It may be urged that a motive of this kind will appear insufficient to the minds of most men;—but what known motive is there sufficient to account for parricide, infanticide, or any other crime of the like horrible nature? It appears to me we must allow either that all crime is the offspring of insanity, or that suicide is occasionally the deliberate act of a *sane* person. To say that suicide is always *per se* evidence of insanity, is to say substantially that there is no criminality in self-murder; for it is impossible to regard that act as a crime, which is committed under a really insane delusion. (See Ann. d'Hyg. 1831, i. 225.) For some judicious remarks on this subject, see Lectures by Dr. Jamieson, Med. Gaz. xlvi. p. 523, and Journ. Psychol. Med. 1850, p. 19.

Suicide a felony.—The law of England very properly treats suicide as felony: those who have attempted and failed in its perpetration are treated as sane and responsible agents, unless there should be very clear evidence of their insanity from other circumstances; and it is pretty certain that the evidence required to establish this must be much stronger than that sometimes admitted in cases of homicide. Thus, had *Oxford* and *M'Naughten* attempted to destroy themselves and failed, and in making the attempt on their own lives by a pistol or otherwise, had accidentally led to the death of a bystander, and had afterwards been tried for the felony, it is almost certain that they would have been convicted. The hypothesis of a *suicidal climax* would have been rejected. The facts adduced at their trial would, most probably, under these circumstances, have been deemed insufficient to establish their insanity and consequent irresponsibility for the attempts on their own lives.

Some singular medico-legal cases have lately occurred, involving the question —how far the act of attempting suicide is indicative of insanity. In the case of The *Queen* v. *Rumball*, (Cent. Crim. Court, May, 1843,) the prisoner was charged with attempting to drown her child. It appeared in evidence that she fastened her child to her dress, and threw herself into a canal with the intention of destroying herself. She was rescued, and was subsequently tried and convicted of the felony of attempting to murder her child by drowning. Had she not been rescued, and had she succeeded in her purpose of self-destruction, it is very probable that the verdict of a jury would have been, as it so frequently is on these occasions,—"Temporary insanity." In the case of *Reg.* v. *Furley*, (Cent. Crim. Court, April, 1844,) the prisoner was convicted of murder under similar circumstances, but the sentence was subsequently commuted. In the case of The *Queen* v. *Gathercole*, 1839, a man was charged with the manslaughter of the deceased, under the following singular circumstances. The prisoner threw himself into a canal for the purpose of drowning himself: the deceased, who was passing, jumped in and rescued him; but by some accident he was himself drowned in the humane attempt. The defence was, that the prisoner was at the time insane, and therefore not responsible for the death of the person who attempted to save him; but this was negatived, and the prisoner was convicted. So if a man intending to shoot himself fails, and by accident shoots a bystander, he will be held responsible, unless there be very clear proof of insanity:—the act,—the attempt itself, taken alone, will not be admitted as evidence.

Suicide in relation to life-insurance.—It is well known that a policy of life-insurance is forfeited by the act of suicide, according to the rules of many Offices; but supposing it to have been really an act of insanity, it has been doubted whether the policy would be legally forfeited. In an equitable view, the policy should not be forfeited under these circumstances, any more than if the party had died accidentally by his own hands. The condition truly implies that the party puts himself to death *deliberately*, and not unconsciously, while labouring under a fit of delirium or insanity. The question was raised in the case of *Borradaile* v. *Hunter* (Dec. 1841.) This was an action brought to recover the amount of a policy of insurance effected on the life of a clergyman who threw himself into the Thames from Vauxhall Bridge, and was drowned. The whole

question turned upon the legal meaning of the words "*die by his own hand,*" which formed the exception in the proviso to the payment of the policy. At the trial of the case, Erskine, J. told the jury, that if the deceased threw himself into the river, knowing that he should destroy himself and intending so to do, the policy would be void:—they had further to consider whether the deceased was capable of distinguishing between right and wrong at the time, or, in other words, whether he had a sufficient knowledge of the consequences of the act to make him a felo-de-se. The jury found that the deceased threw himself into the water, intending to destroy himself, and that previously to that time there was no evidence of insanity. They were then directed to take the act itself, with the previous conduct of the deceased, into consideration, and say whether they thought at the time he was capable of knowing right from wrong. They then found that he threw himself from the bridge with the intention of destroying himself, but that he was not then capable of judging between right and wrong. The jury were here evidently perplexed with the strict meaning of the words right and wrong:—the first part of the verdict made the case one of felo-de-se, the last part made it one of insanity. The verdict was entered for the defendants; *i. e.* that the deceased was a felo-de-se, and that the policy was therefore void. The case was subsequently argued before the four judges in the Common Pleas, May, 1843: it was contended for the plaintiff, that according to the terms of the policy there must have been an *intention* by the party assured, to "die by his own hands;" and that an insane person could have no controllable intention. The judges differed:—three considered that there was no ground for saying that the deceased was affected by an uncontrollable impulse,—on the contrary, the jury had found that he threw himself into the river, knowing that he should destroy himself, and intending to do so. In their opinion, the act was one of felo-de-se, and the policy was void. Tindal, C. J. considered that the verdict should be for the plaintiff, thereby leading to the inference that the act of suicide was in this case the result of insanity, and not of a felonious killing, to which alone he considered the exception in the proviso should apply. It is probable that if the term "*suicide*" had been inserted in the policy, instead of "*die by his own hand,*" the decision would have been in favour of the plaintiffs; for to vitiate a policy from an accidental result depending on an attack of insanity, and *flowing directly from that attack*, is virtually vitiating it for the insanity itself! In this respect, it appears that the learned Chief Justice took a most sound and equitable view of this question, so important to the interests of those who have insured their lives. It is impossible for a man to enter into a contract *against an attack of insanity*, any more than against an attack of apoplexy! The jury found that the deceased was irresponsible for the act, and it is clear that the insurers and insured intended no more, by using the term "die by his own hand," than the act of suicide. By this decision, therefore, the insurers received the benefit of a wider interpretation of the terms than that which either party could have foreseen.

This question was again raised in the case of *Schwabe* v. *Clift*, Liverpool Summer Assizes, 1845. (Med. Gaz. xxxvi. 826.) The deceased, whose life was insured, destroyed himself by taking sulphuric acid. There was clear evidence of his being at the time in a state of insanity. The jury here, under the direction of Cresswell, J., took a most proper view of the subject, and returned a verdict for the plaintiffs, thereby deciding that the policy was not vitiated by the mere act of *suicide*. The learned judge held that to bring the case within the terms of the exception, the party taking his own life must have been *an accountable moral agent, and able to distinguish right from wrong*. In this case, the term "suicide" was used in the policy, which the learned judge held to imply "a *felonious* killing." Supposing that the insured party was killed by voluntarily precipitating himself from a window while in a fit of delirium from fever, this would be an act of suicide or dying by his own hand; but it surely cannot be equitably contended that his heirs should lose the benefit of

the insurance in consequence of an event depending on an accidental attack of a disease which no one could have foreseen, and against which no one could guard. If this principle be not admitted, the decision which must necessarily follow would appear to be against all equity; if it be admitted, then it must apply equally to every case of mental disorder, the proof of the existence of this resting with those who would benefit by the policy. On an appeal, the judgment in this case was, however, reversed, the judges again differing. It was argued for the insurers, that if a man retained just enough of *intelligence* to produce death by competent means, but was deprived of all *moral sense*, the policy was void. Against this view, it was urged by one of the judges, that whether the intellect was destroyed altogether, or only partially, it would make no difference. If death was the result of disease, whether by affecting the senses or by affecting the reason (thus leading to suicide,) the Insurance office was liable under the policy. If the act was not the act of a sane and reasonable creature, it was not an act of suicide within the meaning of the proviso. Those judges who adopted the opposite view held that the meaning of the words, as introduced into the exception, was—if the party should kill himself *intentionally*. The words were considered to include all cases of voluntary self-destruction. If a party voluntarily killed himself, it was of no consequence whether he was sane or not. The majority of the Court held this view, and a new trial was granted. Had all the judges been present to give their opinions, the decision might have been different, for five have already expressed themselves, at various times, in favour of the view, that the term "suicide" in policies, applies, as it ought to do, only to cases in which there is no evidence of insanity; while four have declared their opinion to be, that it includes all cases of "intentional" self-killing, whether the person be sane or insane. It is difficult to understand how a man in a fit of delirium or insanity can be said to kill himself voluntarily or intentionally. Will and intention imply the judgment of a sane man in regard to all civil and criminal acts; but a delirious or really insane person acts under a delusion, and as the law would hold him irresponsible in regard to others, his representatives should not suffer for an act which he was himself incapable of controlling. (Law Times, July 18, 1846, p. 342.)

The decision in this case is of great importance to persons whose lives are insured; for it may be made to govern others; and on this principle, a man attacked with delirium, and who during the fit precipitated himself from a window, and was killed, would be declared a suicide within the meaning of the proviso, and a policy of insurance on his life would be *ipso facto* void. It will be perceived from this decision, that the law, as at present interpreted by the majority of the judges, is, that whenever a person destroys himself *intentionally*, whatever may be the state of his mind, the policy becomes void. It also appears that according to this legal view of the question, a person may have and exercise this intention, although undoubtedly *insane*. Whether he have been so found under a commission, or a verdict to this effect have been returned by a coroner's jury, is therefore unimportant. It must be proved by those who would benefit by the policy that the party died from his own act without *intending* to destroy himself. If a man take poison, or shoot himself, or commit any other act leading to his own death, it must be shown that it was the result of *accident*, and not of *design* on his part. Some Insurance-offices now insert in the contract a proviso by which, whether the person be found *felo-de-se* or not, the policy shall be forfeited; but they reserve to themselves a power of returning a part or the whole value of the policy, calculated up to the day of death. In the mean time, they have the power of taking the full benefit of the act of suicide committed during a fit of delirium or insanity, in which, as medical men know, there can exist no controllable intention, no freedom of judgment, and no real exercise of will. (See case, Prov. Med. Jour. Aug. 9, 1848, 428.)

From these cases one point is clear,—the act of suicide is not treated by the law as a necessary *proof of insanity;* and therefore the ingenious arguments

which have been held on this subject have but little interest for the medical jurist in a practical view. It has been elsewhere stated that acts of suicide have been mistaken for homicide, merely because the deceased had expressed no *intention* of destroying himself, and had manifested no disposition to the act by his previous conduct. This, however, is a very fallacious view of the subject; since suicide from sudden impulse is by no means unfrequent; and even where the act bears about it marks of deliberation, it is not to be expected that the individual should previously announce his intention; for this would be a sure way of defeating his object. Perhaps one of the most remarkable instances of suicide from sudden impulse is the following, which is related by Sir Charles Bell. Many years since, one of the surgeons of the Middlesex Hospital was in the habit of going every morning to be shaved by a barber in the neighbourhood, who was known as a steady, industrious man. One morning some conversation arose about an attempt at suicide which had recently occurred; and the surgeon remarked that the man had not cut his throat in the right place. The barber then casually inquired where the cut should have been made, and the surgeon pointed to the situation of the carotid artery. A few minutes afterwards, the surgeon was alarmed by hearing a noise at the back of the shop, and on rushing to the spot, found that the barber had cut his own throat with the razor with which he had been shaving him. The man speedily died!

If, as it is alleged, the act of suicide was in all cases the offspring of insanity, suicide should be very frequent among the insane. Experience, however, is not in favour of this assumption. The report of the Commissioners of Lunacy for 1850, shows that there were then confined as lunatics 15,079 persons, while the suicides for the year among this large number amounted to only eight, of which six were perpetrated by strangulation. As mechanical restraint is either abolished or considerably diminished in most asylums, lunatics have now much more liberty than formerly, and yet suicides among them are comparatively rare. This favourable result must be in part ascribed to active superintendence and watching.

Hereditary taint.—The tendency to suicide is undoubtedly hereditary. Dr. Burrows relates an instance in which this propensity declared itself through three generations:—in the first, the grandfather hanged himself: he left four sons: one hanged himself, another cut his throat, and a third drowned himself in an extraordinary manner after having been some months insane: the fourth died a natural death, which, from his eccentricity and unequal mind, was scarcely to be expected. Two of these sons had large families: one child of the third son died insane—two others drowned themselves, another became insane and made the most determined attempts on his life. Several of the progeny of this family, being the fourth generation, when they had arrived at puberty, bore strong marks of the same fatal propensity.

PUERPERAL MANIA.

A homicidal propensity towards their offspring sometimes manifests itself in women soon after parturition. It seldom appears before the third day, often not for a fortnight; and in some instances not until several weeks after delivery. The most frequent period is at or about the commencement of lactation, and between that and the cessation of the lochia. According to Esquirol, it is generally attended by a suppression of the lochia and milk. The symptoms do not differ from those of mania generally; but it may assume any of the other forms of insanity; and in one half of the cases it may be traced to hereditary tendency. According to Dr. Burrows, there is delirium, with a childish disposition for harmless mischief. The woman is gay and joyous, laughing, singing, loquacious, inclined to talk obscenely, and careless of every thing around. She imagines that her food is poisoned: she may conceal the suspicion, and merely avoid taking what is offered to her. She can recognise persons and things, and can, though

perhaps will not, answer direct questions. Occasionally there is great depression of spirits with melancholia. These facts are of some importance in cases of alleged child-murder. This state may last a few hours, or for some days or weeks, [sometimes for months or years; but it generally goes off within a few months, if not earlier.—H.] The murder of the child is generally either the result of a sudden fit of delirium, or of an uncontrollable impulse, with a full knowledge of the wickedness and illegality of the act,—so that the legal test of responsibility from a knowledge of right and wrong cannot be applied to such cases. Mothers have been known, before the perpetration of the murder, to request their attendants to remove the child. Such cases are commonly distinguished from deliberate infanticide by there being no attempt at concealment, nor any denial of the crime on detection. Several trials involving a question of puerperal mania, have been decided, generally in favour of the plea, within the last few years. Dr. Ashwell has remarked that undue lactation may give rise to an attack of mania, under which the murder of the offspring may be also perpetrated. (Diseases of Women, 732.) Females in the *pregnant* state have been known to perpetrate this crime apparently from some sudden perversion of their moral feelings. I am not aware that a plea of exculpation on the ground of insanity has been admitted in this country under these circumstances. (See case, Ann. d'Hyg. 1831, i. 374.) [Puerperal insanity certainly occurs to some women in the pregnant state, but we do not remember an instance in this country of criminal misconduct having been attributed to such a cause.—H.] For an able analysis of the present state of our knowledge on the subject of Puerperal Insanity, by Dr. Reid, see Jour. Psychol. Med. 1848, pp. 128, 284.

PYROMANIA.

Propensity to incendiarism.—This is described as a variety of monomania in which there is a morbid disposition of mind, leading to acts of incendiarism without any motive. It is said to proceed from sudden impulse, or from delusive reasoning, but most commonly the latter. It has been chiefly remarked in females about the age of puberty, and is supposed to be connected with disordered menstruation. An extraordinary instance of pyromania is quoted in the case of *Jonathan Martin*, who fancied himself to be deputed from God to burn down the cathedral of York, in order to do away with the heresies which he supposed to exist in the church. It is said to be not uncommon in young persons of both sexes, about the age of puberty. Admitting that a morbid impulse of this kind may exist, it should be very cautiously received as an exculpatory plea, since otherwise it might be easily converted into a means for withdrawing real criminals from all legal control; and I would here especially direct the attention of the reader to an essay on this subject by Professor Casper, of Berlin, in which he denies the existence of such a propensity as connected with insanity. He believes that incendiarism is always a criminal act, and, unless there be clear evidence of a perverted mind, that it should be always punished as such. (Denkwürdigkeiten zur Med. Stat-Berlin, 1846, 255.) This plea has been already admitted in English law (see cases, Med. Gaz. xii. 80,) but chiefly in those instances in which there was strong reason to suspect intellectual aberration. In one recent case (*Reg.* v. *White*, Wilts Summer Ass. 1846,) the prisoner was convicted on the principle that, although of weak intellect, she knew right from wrong. (See Ann. d'Hyg. 1833, ii. 357; 1834, ii. 94.) Among several important trials in which this plea has been urged in defence, the one most interesting to the medical jurist is that of *James Gibson*, tried before the High Court of Justiciary, Edinburgh (Dec. 23, 1844,) and of which a very full report will be found in Cormack's Edinburgh Journal, February, 1845, page 141. The prisoner was charged with setting fire to certain premises, and the defence chiefly rested upon the allegation that he was in a state of mind which rendered him irresponsible for the act. The medical evidence was generally in favour of the

insanity. The Lord Justice Clerk (Hope) in a very elaborate charge to the jury, laid down for their guidance most of the legal propositions which have been already discussed under homicidal mania. He remarked, that they were "not to consider insanity according to the definitions of medical men—especially such fantastic and shadowy definitions as are to be found in Ray, whose work was quoted by the counsel for the panel, and in many other medical works on the subject." He adopted Mr. Alison's view, that the consciousness of right and wrong must be applied to *the particular act*, and not to crime in the abstract. "The duty of deciding this question is with the jury; it is not to be delegated to medical men, and by relying upon their own judgment, their decision would be nearer the truth than that of any body of medical witnesses." The jury negatived the plea, and the prisoner was sentenced to transportation for fourteen years. It appears to me, from the whole of the evidence, that there was no more insanity in the case of this man than in the case of *M'Naughten;* and had the latter robbed Mr. Drummond of his property, or burnt his house down, instead of shooting him, he would probably have been convicted and transported. In the case of *Reg.* v. *Elderfield*, Guildford Summer Ass. 1844, the prisoner was charged with arson, and Gurney, B., left it to the jury to say, not whether the prisoner had a weak or silly mind, but whether, at the time he committed the act, he was in such a state of mind as to know what he was about, and to be capable of distinguishing between right and wrong. The prisoner was acquitted on the ground of insanity. In another case (*Reg.* v. *Watts*, Norwich Winter Ass. 1844,) the plea was negatived under the direction of the judge.

KLEPTOMANIA.

Propensity for theft.—This term has been applied by Marc to that form of monomania which manifests itself by a propensity to acts of theft. It has been remarked by him and others that this propensity has often shown itself in females labouring under disordered menstruation, or in those who were far advanced in pregnancy, the motive being the mere wish of possession. Pregnancy, according to him, should be a good exculpatory plea, when a well educated woman, of strictly moral conduct, steals some unimportant article of no value compared with her worldly means and position in society. There are many instances on record showing that well educated persons moving in a respectable sphere of society have been guilty of petty acts of theft. The articles taken have been valueless compared with their means. Instances of this kind have been brought before our Police-courts; and this motiveless impulse to theft has been occasionally pleaded; but in most of them the following facts have been established by evidence:—1. A perfect consciousness of the act. 2. The article, although of trifling value, has still been of some use to the person,—thus these females have stolen articles only adapted to female use. 3. There have been art and precaution in endeavouring to conceal the theft; and, 4, either a denial of the act when detected, or some evasive excuse. When circumstances of this kind are proved, either the parties should be made responsible, or theft should be openly tolerated. The evidence of a disordered state of the mind should not here be allowed to depend on the nature of the act, or every morally depraved person might bring forward a plea of insanity for any crime or offence. (See case, Ann. d'Hyg. 1838, ii. 435.) When the plea of insanity is raised in respect to other cases of theft, the rule appears to be, per Tindal, C. J., that there should be proof that the prisoner was incompetent to know that the particular act in question was a wrong one. (*Reg.* v. *Vaughan*, Monmouth Summer Ass. 1844.) In one instance, an acquittal took place apparently on the ground of insanity (kleptomania) from amenorrhœa. (Carlisle Summ. Ass. 1845, *Reg.* v. *Shepherd.*) Cormack's Ed. J., Aug. 1845, p. 632.

DIPSOMANIA. DRUNKENNESS.

Civil responsibility of drunkards.—This state, which is called, in law, frenzy or "*dementia affectata*," is regarded as a temporary form of insanity. Jurists and legislators have differed widely respecting the degree to which drunkards should be made responsible for their acts. When the mind of a man is completely weakened by *habitual* drunkenness, then the law infers irresponsibility, unless it plainly appear that the individual was at the time of the act, whether of a civil or of a criminal nature, endowed with full consciousness and reason to know its good or evil tendency. Any *deed* or *agreement* made by a party when drunk is not invalidated by our law, except in the case where the intoxication has proceeded so far as to deprive him of all consciousness of what he is doing; and a Court of Equity will not interfere in other cases, unless the drunkenness were the result of collusion by others for the purposes of fraud. When the drunkenness has occasioned a temporary loss of the reasoning powers, the party is incapable of giving a valid consent, and, therefore, cannot enter into a contract or agreement, for this implies *aggregatio mentium, i. e.* a mutual assent of the parties. Partial drunkenness, therefore, provided the person knew what he was about, does not vitiate a contract or agreement into which he may have entered. Thus the law appears to make two states in drunkenness;—one where it has proceeded to but a slight extent, and where it is considered that there is still a power of rational consent; another where it has proceeded so far that the individual has no consciousness of the transaction, and therefore can give no rational consent. The proof of the existence of this last state would vitiate all the civil acts of a party. A confession made by a man while in a state of drunkenness, is legally admissible as evidence against him and others, provided it be corroborated by circumstances. In a case tried a few years since, the prisoner confessed, while drunk, that he had committed a robbery and murder which had taken place some time before, but of which he had not been suspected. He mentioned a spot where the property of the murdered person had been concealed by him, and the whole of the circumstances of the murder. The property was found as he had described, and the case was clearly brought home to him, chiefly by collateral evidence from his own confession. He was convicted. In a case tried at the Central Criminal Court in Oct. 1849, a man pleaded his drunkenness at the time of his first marriage, as a defence to a charge of bigamy. There was some evidence to show that he was drunk when the ceremony was performed. He was, however, convicted. (Med. Gaz. xliv. p. 762.)

Criminal responsibility of drunkards.—When *homicide* is committed by a man in a state of *drunkenness*, this is held to be no excuse for the crime. If voluntarily induced, whatever may be its degree, it is not admitted as a ground of irresponsibility, even although the party might not have contemplated the crime when sober. (*Reg.* v. *Reeves*, Derby Winter Assizes, 1844.) Thus it would appear that when the state of drunkenness is such that any civil act of the person would be void, he may still be held legally responsible for a crime like murder. Some judges have admitted a plea of exculpation, where the crime has been committed in a state of frenzy arising from *habitual drunkenness;* but even this is not general. The question, whether the person was or was not drunk at the time of committing a crime, may be, however, occasionally of some importance. It was held by Patteson, J., that although drunkenness is no excuse for any crime whatever, yet it is of very great importance in cases where it is a question of *intention*. A person may be so drunk as to be utterly unable to form any intention at all, and yet he may be guilty of very great violence. (*Reg.* v. *Cruse*, 8 C. & P. 546.) Again, where it is a question whether the accused was actuated by malice or not, the jury will have to take the fact of drunkenness into consideration, and this may have an influence upon their verdict. While, then, drunkenness does not furnish any excuse for a crime, it is often material

with reference to the *intent* with which an act has been perpetrated. (Law Times, Sept. 27, 1845, p. 542.) It is obvious that if drunkenness were to be readily admitted as a plea of irresponsibility, three-fourths of the whole of the crimes in this country would go unpunished. In those cases where the head has sustained any physical injury, as it often happens with soldiers and sailors, drunkenness, even when existing to a slight extent, produces sometimes a fit of temporary insanity, leaving the mind clear when the drunken fit is over. The law makes no distinction between this state and ordinary drunkenness, although juries occasionally show by their verdicts that some difference ought to be made. (See cases in Alison, 653.)

Illusions.—Hallucinations and illusions are a very common effect of drunkenness, and often lead to the commission of criminal acts. Marc relates a case, where two friends being intoxicated, the one killed the other under an illusion that he was an evil spirit. The drunkenness of the accused was held to have been voluntary; and he was condemned to ten years' imprisonment with hard labour. A case of this description was tried at the Norfolk Lent Assizes, 1840. (The *Queen* v. *Patteson.*) A man while intoxicated killed his friend, who was also intoxicated, under the illusion that he was some other person who had come to attack him. The judge made the guilt of the prisoner to rest upon whether, had he been sober, he would have perpetrated the act under a similar illusion! As he had voluntarily brought himself into a state of intoxication, this was no justification. He was found guilty of manslaughter, and sentenced to two months' imprisonment.

The proof of drunkenness may fail, but still, if the party charged with the death acted under an illusion, he will be acquitted. In the case of *Reg.* v. *Price* (Maidstone Summer Ass. 1846,) it was proved that the prisoner, who had been on friendly terms with the deceased, was going home at night, having previously been in company with the deceased at a public house, when, according to his statement, a man sprang upon him from the hedge by the road-side, and demanded his money and his watch, or else he said he would have his life, and the prisoner closed with him and beat him severely, inflicting such injuries that he died very shortly afterwards. This man turned out to be the deceased, and it was supposed that he made the pretended attempt to rob the prisoner out of a joke, which, however, ended in this fatal manner. The prisoner all along told the same story, and there did not appear to be the slightest ground for believing that it was untrue. Coltman, J., after hearing the evidence of the witnesses, said it appeared to be quite clear that the prisoner had acted under the impression that he was protecting his own life from the attack of a robber, and under such circumstances he could not be held to be criminally responsible. The jury accordingly returned a verdict of *not guilty*, and the prisoner was discharged.

Restraint.—Interdiction.—Drunkenness, even when habitual, is not a sufficient ground for the imposition of restraint or interdiction in the English law. Thus, on a commission in Nov. 1836, (*In ré Holden*) a jury returned that the party was of weak mind and given to habits of drunkenness, but that he was not of unsound mind. On application, the Lord Chancellor refused to interfere.

DELIRIUM TREMENS.

This is a disordered state of mind which proceeds from the abuse of intoxicating liquids. Habitual drunkenness appears to be the predisposing, while abstinence from drink is the immediately exciting cause. Thus, the disorder frequently does not show itself until the accustomed stimulus has been withdrawn for a certain period. It commences with tremors of the hands, by which it is known from ordinary delirium, and restlessness; and the individual is subject to hallucinations and illusions, sometimes of a horrible kind, referring to past occupations or events. The patients are often violent, and prone to commit sui-

cide or murder, more commonly the former; hence they require close superintendence. Persons labouring under this disorder are incompetent to the performance of any civil act, unless the mind should clear up before death. They are not responsible for criminal acts committed while they are labouring under an attack. Acquittals have even taken place on charges of murder, where there was deliberation as well as an apparent motive for the act. Thus, then, although this disorder is voluntarily brought on by habitual drunkenness, the law admits it as a sufficient plea for irresponsibility; while in a case of confirmed drunkenness, it rejects the plea. Why the mere circumstance of the one being a remote consequence, and the other not, should create irresponsibility, it is difficult to explain. [In the one case the disordered intellect may be produced designedly and intentionally, and nearly always knowingly, whereas the delirium of mania-a-potu, in ordinary cases, comes on like other diseases of the mind, is not a necessary or invariable result of indulgence in intoxicating drinks, and, except in rare cases, cannot be produced at will like ordinary intoxication. The plea in the one case, therefore, might be made available to an unlimited and most dangerous extent; but could not in the other, from the very nature of the affection.—H.]

A trial has recently taken place in which the evidence showed that the homicide had been committed by an individual while labouring under an attack of delirium tremens (*Reg.* v. *Simpson*, Appleby Sum. Ass. 1845.) The prisoner's mind had become unsettled from an attack of this disorder brought on by habitual drunkenness. In another case, the plea was also admitted without difficulty. (*Reg.* v. *Watson*, York Winter Ass. 1845.) [See Ray, Med. Jur. of Insanity, Lee's edition of Guy's For. Med., and Beck's Med. Jur. vol. i., for a much more extended and detailed discussion of the medico-legal relations of mental alienation than the limits of this manual allow.—H.]

SOMNAMBULISM.

It has been a contested question among medical jurists, how far a person should be held responsible for a criminal act, perpetrated in that half-conscious state which exists when an individual is suddenly roused from sleep. There is no doubt that the mind is at this time subject to hallucinations and illusions which may be more persistent in some persons than in others; but it is difficult to suppose, unless we imagine that there is a sudden access of insanity, that an individual should not recover from his delusion, before he could perpetrate an act like murder. A remarkable case of this description, that of *Bernard Schedmaizig*, will be found in Marc (i. 56;) and a trial involving this question occurred in England a few years since. A pedlar who was in the habit of walking about the country armed with a sword-stick, was awakened one evening, while lying asleep on the high road, by a man, who was accidentally passing, seizing and shaking him by the shoulders. The pedlar suddenly awoke, drew his sword, and stabbed the man, who soon afterwards died. He was tried for manslaughter. His irresponsibility was strongly urged by his counsel on the ground that he could not have been conscious of an act perpetrated in a half-waking state. This was strengthened by the opinion of the medical witness. The prisoner was, however, found guilty. Under such circumstances, it was not unlikely that an idea had arisen in the prisoner's mind that he had been attacked by robbers, and therefore stabbed the man in self-defence. (The *Queen* v. *Milligan*, Lincoln Aut. Assizes, 1836.) [A somewhat similar case occurred in this city, some two or three years ago, in which a man was shot with a pistol by an acquaintance whom he had suddenly aroused from sleep late at night in an open market house. The plea was that the deceased was mistaken for a robber when the pistol was fired. Jury found a verdict of manslaughter.—H.] The following remarkable case is quoted by Mr. Best. Two persons who had been hunting during the day slept together at night. One of them was renewing the chase in his dream, and imagining

himself present at the death of the stag, cried out, "I'll kill him! I'll kill him!" The other awakened by the noise, got out of bed, and by the light of the moon beheld the sleeper give several deadly stabs with a knife on that part of the bed which his companion had just quitted. Suppose a blow, given in this way, had proved fatal, and the two men had been shown to have quarrelled previously to retiring to rest! (Presumptions of Law and Fact.) A defence of this kind may be unduly strained. Thus, where there is enmity, with a motive for the act of homicide, the murderer, while sleeping in the same room, may select the night for an assault, and perpetrate the act in darkness, in order the more effectually to screen himself. In the case of *Reg.* v. *Jackson*, (Liverpool Autumn Ass. 1847,) it was urged in defence, that the prisoner, who slept in the same room with the prosecutor, had stabbed him in the throat, owing to some sudden impulse, during sleep; and the case of *Milligan* above given was quoted by the learned counsel, in support of the view that the prisoner was irresponsible for the act. It was proved, however, that the prisoner had shown malicious feeling against the prosecutor, and that she had wished him dead. The knife with which the wound had been inflicted bore the appearance of having been recently sharpened, and the prisoner must have reached over her daughter (the prosecutor's wife) who was sleeping in the same bed with him, in order to produce the wound. These facts were quite adverse to the supposition of the act having been perpetrated under an impulse from sleep, and the prisoner was convicted. In another case, *Reg.* v. *French* (Dorset Autumn Ass. 1846,) it was proved that the prisoner, while sleeping in the same room, had killed the deceased, who was a stranger to him, under some delusion. There was, however, clear evidence that the prisoner was insane, and on this ground he was acquitted under the direction of the judge.

Somnambulism may become a subject of discussion under a contested policy of life-insurance, in which it may be provided that it shall be vitiated by suicide. If a man falls from a height, and is killed while in a state of somnambulism—would this be considered an act of suicide within the meaning of the policy? The proviso against suicide has been held to include only *intentional* killing. (See case, ante, *Borradaile* v. *Hunter*, p. 591; also, Med. Gas. xxxvi. p. 826;) and in death under these circumstances the killing cannot be said to be intentional; it can only be regarded as an accident. Therefore it is reasonable to infer that the policy would not be void. It is impossible, however, to lay down any general rules relative to cases of this description; since the circumstances attending each case will sufficiently explain how far it was likely that the act of murder or suicide had been committed during a state of somnambulism, or under an illusion continuing from a state of sleep.

THE DEAF AND DUMB.

It was formerly laid down in the old law-books, that a person born deaf and dumb was by presumption of law an idiot; but in modern practice, want of speech and hearing does not imply want of capacity either in the understanding or memory, but only a difficulty in the means of communicating knowledge; and where it can be shown that such a person has understanding, which many in that condition discover by signs, he may be tried, and suffer judgment and execution. (Archbold.) A deaf and dumb person is not incompetent to give evidence unless he be also blind. He may be examined through the medium of a sworn interpreter who understands his signs. This condition does not justify restraint or interdiction, unless there be at the same time mental deficiency. A deaf and dumb person who has never been instructed is altogether irresponsible for any action, civil or criminal. Such a person cannot even be called on to plead to a charge, when there is reason to suppose the nature of the proceedings cannot be understood. A deaf and dumb female was charged with cutting off the head of her child. By signs she pleaded not guilty, but she could not be

made to understand the nature of the other proceedings against her. Upon this she was discharged, and subsequently confined as a criminal lunatic. In *Reg.* v. *Goodman*, (Stafford Summer Ass. 1841,) a deaf and dumb man was convicted of theft and sentenced to imprisonment. He was made to comprehend the proceedings by signs and talking with the fingers. In *Reg.* v. *Brooke*, (Buckingham Summer Ass. 1842,) the prisoner could read and write well. He was charged with feloniously cutting and stabbing. The proceedings were reported to him in writing. He was convicted, and the judge (Alderson, B.) having sentenced him to a year's imprisonment, handed down his judgment in writing, which he recommended him to read and ponder over in prison! In *Reg.* v. *Jackson*, (Bedford Summer Ass. 1844,) Alderson, B., held, that before the evidence of a dumb witness can be received, the Court must be satisfied that he understands the obligation of an oath. It has been decided in the Ecclesiastical Courts, that the consent of a deaf and dumb person given by signs, renders a matrimonial contract valid, provided the individual have a full and proper understanding of their meaning.

Feigned deafness and dumbness.—From these statements it will be perceived that medical evidence is of but little importance in relation to the deaf and dumb. Indeed, there are only two cases in which this kind of evidence is likely to be called for: 1, where there is accompanying *mental deficiency*, in which case the general rules given under insanity apply; and 2dly, where there is a suspicion that the deafness and dumbness are *feigned*. There can be commonly no great difficulty in detecting an imposition of this kind. It will be found that the alleged deafness and dumbness did not come on until a motive existed, and that there was no apparent cause, but the very suspicious one of evading the responsibility for some offence committed. It requires great skill to maintain this imposture. Such persons are immediately thrown off their guard by addressing them in a voice a little above or a little below the common conversational tone. A change in the eye or the features will at once indicate that they hear what is said. The ignorant impostor may be dealt with on the principle of "*ars est celare artem*," by seriously proposing in a low voice to some medical friend who may be present, the necessity for the performance of some formidable surgical operation. The production of amputating instruments has been known to have a wonderful effect! If the impostor can write, he may perhaps be detected by the ingenious plan adopted by the Abbé Sicard. When the deaf and dumb are taught to write they are taught by the eye. The letters are only known to them by form, and their value in a word can be understood only by their exact relative position with respect to each other. A half-educated impostor will spell his words, or divide them incorrectly, and the errors in spelling will have reference to sound; therefore indicating that his knowledge has been acquired through the *ear*, and not alone through the eye. A man who had defied all other means of detection, wrote down several sentences, in which the misspelling was obviously due to errors produced by the *sound* of the words. The Abbé pronounced the man to be an impostor without seeing him, and he subsequently confessed the imposition.

GLOSSARY.

Abdo'men, from *abdere*, to conceal. The lower cavity of the body, containing the stomach, bowels, liver, and other organs.

Abnor'mal, from *ab*, from, and *norma*, rule. Irregular; a deviation from natural order or arrangement.

Abor'tion, from *ab* and *oriri*, to rise. Applied to that which is prematurely produced: synonymous with *Miscarriage*. The term is also applied to the product of an untimely birth.

Abra'sion, from *ab* and *radere*, to rasp. A superficial loss of substance in small shreds, applied to the skin or mucous membrane.

Ab'scess, from *abscedo* (*abs* and *cedere*,) I depart or separate from. A collection of pus in a cavity as the result of disease.

Absorp'tion, from *absorbere* (*ab* and *sorbere*,) to drink or suck up. A function performed by certain vessels in the body, called absorbents, as also by the veins.

Acar'dia, from *a*, priv., and καρδια, the heart. The state of a fœtus without a heart.

Aceph'alous, from *a*, priv., and κεφαλη, the head. A fœtus born without a head.

Achillis Tendo. The strong tendon of the heel.

Ac'inus, from *acinus*, a grape-stone. The termination of a secretory artery in a gland.

Ac'rid, from ακρος, a point or summit. Applied to substances of an irritating kind.

Adeni'tis, from αδην, a gland, and *itis*, a termination, denoting inflammation. Glandular inflammation.

Ad'ipocere, from *adeps*, fat, and *cera*, wax. A kind of soap formed from the decomposition of animal matter in water.

Adynam'ic, from *a*, priv., and δυναμις, strength. Applied to debilitating diseases.

Albuminu'ria. The condition of the urine in which it contains albumen.

Alexiphar'mic, from αλεξειν, to repel, and φαρμακον, a poison. An antidote.

Allan'tois, from αλλας, a sausage, and ειδος, shape. A sort of elongated bladder, forming one of the coverings of the fœtus.

Alope'cia, from αλωπηξ, a fox. Loss of the hair.

Alve'olar, from *alveus*, a cavity. Applied to the sockets of the teeth.

Amenorrhœ'a, from *a*, priv., μην, a month, and ρεω, I flow. Suppression of the menses.

Amen'tia. Applied to the state of idiocy.

Am'nios, from αμνος, a sheep. Applied to the innermost membrane covering the fœtus.

Anæ'mia, from *a*, priv., and αιμα, blood. Privation of blood.

Anæsthe'sia, from *a*, priv., and αισθανομαι, I feel. Privation of sensation.

Anasar'ca, from ανα, through, and σαρξ, the flesh. Diffusion of fluid in the cellular membrane; general dropsy.

Anastomo'sis, from ανα, with, and στομα, a mouth. A communication between two blood-vessels.

Anence'phalus, from *a*, priv., and εγκεφαλος, brain. A monster devoid of brain.

An'eurism, from ανευρυνειν, to dilate. The dilatation of an artery from disease.

Ankylo'sis, from αγκυλος, crooked. Applied to a bony union of a joint from disease.

Anserina Cutis, from *anser*, a goose. A contracted state of the skin from cold.

An'tidote, from αντι, against, and διδωμι, I give. A remedy against poisoning.

Antiphlogis'tic, from αντι, against, and φλεγω, I burn. Opposed to inflammation.

Antisep'tic, from αντι, against, and σηπτος, putrid. Opposed to putrefaction.

Apnœa, from *a*, priv., and πνεω, I breathe. Prevention of breathing: synonymous with Asphyxia.

Are'ola, dim., from *area*, space. Applied to the spaces between the fibres of organs; also to the coloured circle surrounding the nipple.

Arthritis, from αρθρον, a joint. Inflammation of the joints.

Asphyx'ia, from *a*, priv., and σφυξις, pulse. Pulselessness. It is applied to that state in which there is a suspension of respiration.

Asthen'ic, from *a*, priv., and σθενος, force or strength. Applied to diseases of a debilitating kind.

At'avism, from *atavus*, an ancestor. A case in which a disease is lost in one generation and reappears in the following.

Atelec'tasis, from ατελης, imperfect, and εκτασις, dilatation. That condition of the lungs in which they have not been distended with air by respiration.

At'las. The name applied to the first vertebra of the neck, owing to its supporting the globe of the head.

At'rophy, from *a*, priv., and τρεφω, I nourish. Emaciation produced by any cause.

Axil'la. The arm-pit.

Bron'chia, from βρογχος, the throat. The ramifications of the bronchi, which are two tubes formed by the division of the trachea.

Cæ'cum, from *cæcus*, blind, as it forms a species of *cul-de-sac*. The upper part of the large intestines.

Cal'lus. The flexible substance deposited between the fractured ends of bones during the process of union.

Carcino'ma, from καρκινος, a crab. Applied to diseases of a cancerous nature.

Car'diac, from καρδια, the heart, or the upper orifice of the stomach.

Cerebel'lum, diminutive of *Cerebrum*. The lower and smaller portion of the brain.

Chron'ic, from χρονος, time. Applied to diseases which are of long duration.

Cica'trix, from the Latin, signifying the scar or mark left on the skin after the healing of a wound or an ulcer.

Clon'ic, from κλονος, agitation. Irregular convulsive motions of the muscles.

Col'ic. A disease attended with severe pain, chiefly referred to the colon.

Co'lon, from κολον, hollow. The middle and longest portion of the large intestines.

Co'ma. A profound state of sleep, in which it is extremely difficult to rouse the individual.

Congestion, from *congerere*, to amass: synonymous with *Engorgement*. An accumulation of blood in an organ.

Conjuncti'va, from *conjungere*, to join. A mucous membrane so called because it joins together the ball of the eye and the eyelids.

Corro'sion, from *con* and *rodere*, to gnaw. The action or effect of corrosive substances.

Crepita'tion, from *crepitus*, noise; a crackling sound. It implies the sound and feeling imparted by air when contained in certain organs; *e. g.*, the lungs.

Crypsor'chides, from κρυπτω, I conceal, and ορχις, testicle. Applied to persons whose testicles have not descended.

Denta'ta. The name applied to the second vertebra of the neck, owing to its having a tooth-like projection.

Diagno'sis, from δια, and γινωσκω, I know. The discrimination of disease.

Di'aphragm, from δια, between, and φρασσω, I close. A large muscle which forms the partition between the chest and abdomen.

Dip'somania, from διψα, thirst, and *mania*. An insane propensity for drinking.

Diso'matous, from δις, twice, and σωμα, the body. A monster with two bodies.

Docima'sia, from δοκιμαζω, I try or prove. Applied to certain means of testing. Docimasia pulmonum.

Duc'tus Arteri'osus. A vessel peculiar to the fœtus, conveying the blood by a short course from the heart to the body.

Duode'num, from *duodecim*. The upper part of the small intestines, connected with the stomach. Its length is about twelve fingers' breadth.

Du'ra Ma'ter. The external covering of the brain: a tough and firm membrane.

Dyspnœa, from δυς, and πνεω, I breathe. Difficulty of breathing.

ECCHYMOSIS, from εκχυω, I pour out. The effusion of blood by which a discoloration of the skin is produced.

EMPHYSEMA, from εν and φυσαω, I blow. Inflation or a diffusion of air through the skin and soft organs.

EMPROSTHOT'ONOS, from εμπροσθεν, forwards, and τεινω, I stretch. A variety of tetanus in which the body is drawn forwards.

ENTERI'TIS, from εντερον, an intestine, and *itis*, denoting inflammation. Inflammation of the bowels.

EPIDER'MIS, from επι, upon, and δερμα, the true skin. The scarf-skin, or cuticle, which covers the true skin.

EPIGAS'TRIUM, from επιγαστριον, the belly. The epigastric region.

EPIGLOT'TIS, from επι, upon, and γλωττις, the glottis. An oval cartilaginous body placed over the glottis.

EP'ILEPSY, from επιλαμβανω, I seize upon. A disease of the brain characterized by a loss of sensation and by convulsive motions of the muscles.

EPISPA'DIA, from επι, above, and σπαω, I draw. A malformation in which the urethra terminates on the upper part of the penis.

EPITHE'LIUM, from επι, upon, and θηλη, a nipple. The thin layer which covers parts deprived of skin, such as the mucous membrane.

ERO'SION, from *e*, and *rodere*, to eat away. The gradual destruction of a part by a corrosive substance. It is often employed in the same sense as *Ulceration*.

ERYSIP'ELAS, from ερυω, I draw on, and πελας, near. Superficial inflammation of the skin with fever, rapidly extending to surrounding parts.

ERYTHE'MA, from ερυθρος, red. An inflammatory state of the skin, applied to erysipelas when local.

ES'CHAR. A slough, a crust, or scab.

EXCORIATION, from *ex*, and *corium*, the skin. A slight wound which removes only the skin.

EXTRAVASA'TION, from *extra*, out of, and *vasa*, vessels. Escape of a fluid from the vessel or organ containing it.

FAS'CIA, from *fascis*, a bundle. A membranous expansion covering the muscles, and binding them together.

GASTRI'TIS, from γαστηρ, the stomach, and *itis*, denoting inflammation. Inflammation of the stomach.

HEM'ORRHAGE, from αιμα, blood, and ρησσω, I break out. A bleeding or flow of blood.

HEMIPLE'GIA, from ημισυς, half, and πλησσω, I strike. A kind of paralysis in which one side of the body only is affected.

HYPERÆ'MIA, from υπερ, over, and αιμα, blood. Congestion of blood in a part.

HYPER'TROPHY, from υπερ, beyond, and τροφη, nourishment. Applied to parts which become morbidly enlarged or developed from excessive nutrition.

HYPOCHON'DRIUM, from υπο, under, and χονδρος, a cartilage. That part of the body on each side which lies under the cartilages of the lower ribs.

HYPOSPA'DIA, from υπο, under, and σπαω, I draw. A malformation in which the urethra terminates at the base or under part of the penis.

HYPOS'TASIS, from υπο, under, and στασις, the act of placing. Morbid depositions in the body.

IDIOSYN'CRASY, from ιδιος, peculiar, συν, with, and κρασις, temperament. A peculiarity of constitution.

IL'EUM, from ειλειν, to turn or twist. The lower portion of the small intestines.

INFILTRA'TION, *infiltratio*, from *filtrare*, to filter. Effusion; the accumulation of fluid in the cells of any texture.

INJEC'TED, from *injicere*, to throw into. An accumulation of blood in the small blood-vessels, so as to produce redness in a part.

INTERCOS'TAL, from *inter*, between, and *costa*, a rib. That which is situated between the ribs.

INTUSSUSCEP'TIO, from *intus*, within, and *suscipio*, I receive. A term applied to that condition of the intestine in which one part becomes received into and locked within another.

JEJU'NUM, from *jejunus*, empty. The middle portion of the small intestines.

KLEP'TOMANIA, from κλεπτω, I steal, and *mania*. Insanity with a propensity to steal.

LAR'YNX, λαρυγξ, a whistle. The organ of voice situated in the front of the throat at the upper part of the trachea.

LEUCORRHŒ'A, from λευκος, white, and ρεω, I flow. A white or coloured discharge from the vagina, called also *fluor albus*.

LOBE. A round projecting part of an organ.

LO'CHIA, from λοχος, a woman in childbed. A serous and sanguineous discharge following delivery.

MARAS'MUS. A wasting of the body.

MEA'TUS. A passage or canal.

MEDULLA OBLONGATA. The portion of the cerebral mass which connects the brain with the spinal marrow.

MENINGE'AL, from μηνιγξ, a membrane. Applied commonly to parts connected with the membranes of the brain.

MENORRHA'GIA, from μην, a month, and ρεω, I flow. A profuse menstrual discharge.

MES'ENTERY, from μεσος, in the middle, and εντερον, intestine. Applied to the folds of the peritoneum which maintain the intestines in their respective situations.

MONOR'CHIDES, from μονος, one, and ορχις, testicle. Persons with one testicle.

NEURAL'GIA, from νευρον, a nerve, and αλγος, pain. Applied to diseases the chief feature of which is pain in the course of a nerve.

ŒDE'MA, from οιδεω, I am swollen. A swelling produced by the accumulation of a serous fluid in the cellular texture under the skin.

ŒSOPH'AGUS, from οιω, I carry, and φαγω, I eat. The gullet.

OLEC'RANON, from ωλενη, the elbow, and κρανον, the head. The projecting point of the elbow.

OPISTHOT'ONOS, from οπισθε, backwards, and τεινω, I stretch. A species of tetanus in which the body is bent backwards.

PARAL'YSIS, from παρα, and λυω, I loosen. Loss of voluntary motion and sensation in one or more parts of the body.

PARI'ETES, from *paries*, a wall. A name given to parts which form the boundaries of cavities.

PERICAR'DIUM, from περι, around, and καρδια, the heart. The membranous bag which envelopes the heart.

PERITONE'UM, from περι, around, and τεινω, I stretch. The membrane which lines the interior of the abdominal cavity, and covers all the viscera.

PERITONI'TIS. Inflammation of the peritoneum; the terminal *itis* denoting inflammation.

PETE'CHIÆ. Small spots, similar in shape and colour to flea-bites, which occur spontaneously on the skin.

PHAR'YNX, from φερειν, to carry. The upper part of the œsophagus or gullet at the back of the throat.

PHLEBI'TIS, from φλεψ, a vein, and *itis*, the termination for inflammation. Inflammation of a vein.

PHREN'IC, φρην, the mind. A term applied to the diaphragm.

PIA MATER. The inner membrane of the brain, of delicate structure. It covers the brain immediately, and dips into its convolutions.

PLACEN'TA, signifying a cake. The soft spongy body adherent to the uterus and connected with the fœtus by the umbilical cord.

PLETHO'RA, from πληθω, I fill. Repletion or fulness.

PLEU'RA, from *pleuroma*, the side or rib. The serous membrane lining the chest and covering the lungs.

PONS VARO'LII. An eminence on the upper part of the medulla oblongata, at the junction of the brain with the spinal marrow.

PROGNO'SIS, from προ, before, and γινοσκω, I know. The judgment formed regarding the progress and termination of a disease.

PROS'TATE, from προ, before, and ιστημι, I stand. A glandular body situated before the neck of the bladder.

PUR'PURA. Applied to a disease in which there are livid spots on the skin. There is great prostration of strength.
PYLO'RUS, from πυλη, a gate, and ουρος, a guardian. The orifice of the stomach, where that organ joins the intestines.
PY'ROMANIA, from πυρ, fire, and *mania*. A propensity to incendiarism.

REC'TUM, from *rectus*, straight. The lower portion of the large intestines.
RETE MUCO'SUM. A layer of the skin to which the colour of races is owing. It is situated between the cuticle and cutis, or true skin.
RU'GÆ; *ruga*, wrinkle. Applied to the folds of the mucous membrane in the interior of the stomach and bowels.

SCIRR'HUS, from σκιρρος, hard. A disease in which parts become hardened, and assume a cancerous character.
SCROBIC'ULUS CORDIS. The pit of the stomach.
SCRO'TUM, from *scorteus*, made of leather. The firm skin which covers the testicles.
STER'TOROUS; *stertor*. The deep snoring which accompanies inspiration in apoplexy and in cases of narcotic poisoning.
STER'NUM. The chest-bone, to which the ribs are attached in front by cartilages.
STRANG'URY, from στραγγων, to squeeze, and ουρον, urine. Great difficulty in passing the urine.
SUBSUL'TUS, from *sub* and *salire*, to make short leaps. Involuntary and sudden contractions of the muscles.
SUGILLA'TION, from *sugillatio*, a black mark. Applied to a bruise, and often used synonymously with *Ecchymosis*.
SYN'COPE, from συγκοπτω, I fall down. Sudden loss of sensation and motion from suspension of the action of the heart.

TENES'MUS, from τεινω, I stretch. Frequent vain and painful desires to go to stool.
TERATOL'OGY, from τερας, a monster, and λογος, discourse. A description of monsters.
TET'ANUS, from τεινω. Spasm with rigidity of the muscles.
THO'RAX, θωραξ, a cuirass, or coat of mail. The chest.
TON'IC, from τεινω, I stretch. Applied to spasm of the muscles when they are in a fixed state of rigidity.
TRACHE'A, from τραχυς, rough, and αρτηρια, artery. An elastic cylindrical tube for the conveyance of air to the lungs.
TRIS'MUS, from τριζω, I gnash. Spasmodic closure of the lower jaw. Lock-jaw.
TURGES'CENCE, from *turgescere*, to swell. Applied to the enlargement or swelling of a part.

VAL'VULÆ CONNIVEN'TES. The folds on the mucous membrane of the small intestines, so called from their converging or approaching one another.
VAS'CULAR, from *vas*, a vessel. That which belongs or relates to blood-vessels.
VEN'TRICLE, from *ventriculus* (dim. of *venter*,) small belly or cavity. Small cavities in organs.
VER'TEBRÆ, from *vertere*, to turn. The bones of the spine.
VER'TEX. The summit of the head.
VI'ABLE, from *via*, a way. A term adopted from the French, to signify that condition of a new-born child in which its organs are so developed as to permit its continued existence.
VIB'ICES. Large purple spots appearing on the skin in malignant fevers; applied also to the striated marks of lividity sometimes seen on the dead body.

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